

ANNUAL REPORT FOR 1936

Northern Rocky Mountain Forest and Range Experiment Station  
Missoula, Montana



**R**  
**Investigative Program**  
**Northern Rocky Mountain Region** February 24, 1937.

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**ANNUAL REPORT FOR 1936**

**and**

**PROGRAM FOR FISCAL YEAR 1938**

**STEPHEN N. WYCKOFF**

**STEPHEN N. WYCKOFF, Director**

- Original to W.O. )
- 1 copy to W.O. ) 3-3-37
- Extra set of Status Sheets (unbound) to W.O. )
- 1 File copy
- 1 extra copy to be used in 1937 for preparing report.



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STATIONING, RECONSTRUCTION, PERSONNEL  
TRAINING, ETC.



P A R T

O N E

STATEMENT OF RESEARCH PLANS AND RESULTS,  
PRINTING REQUIREMENTS, PERSONNEL  
TRAINING, ETC.



## INVESTIGATIVE COUNCIL

Last year all interested research agencies in the Region assembled at Missoula for a general meeting lasting two days. It has been mutually agreed with the Regional Forester that this meeting will be dispensed with this year and the small group conference method of considering the research program will be used. If found to meet our needs more satisfactorily this method may be adopted as a permanent procedure. It is planned to get a critical review of the results of current research projects and concrete suggestions for new work from key men in each field of endeavor covered by the Station.

## SOME IMPORTANT RESULTS AND FACTS DEVELOPED BY RESEARCH

### FOREST PROTECTION

1. Fire control planning and fire danger measurement principles, originated by this Station, were accepted for national application as contributing to more efficient fire control at less cost.

2. Publications were issued on each of these phases, one as a progress report and the other as U.S.D.A. Circular No. 398, as guides in widespread application of these principles.



vegetat 3. The system of fire danger measurement was extended in Region One to include the remaining Forests in eastern Montana.

4. The technic of measuring danger was improved by the manufacture of a new type of visibility meter.

of the 5. The technic was further improved by incorporating vegetative condition into the danger measurement scheme. This important factor could be accounted for, in the past, only on the basis of calendar date, which was at best but a crude criterion. Cumulative maximum temperature was found to be a more sensitive and accurate criterion.

6. Important differences in fire danger according to altitude and aspect were charted systematically for the first time. These charts reveal the existence of three altitudinal strata, each of which warrants or permits different quantities of fire control facilities and different intensities of protection for most efficient fire control at least cost.

5. Results from cheap methods of reseeding since

#### RANGE RESEARCH

1933 on an aggregate of 1,304 acres to more than 20 species show that crested wheatgrass is by far the most promising for eastern Montana under the worst drought conditions that have occurred there in more than half a century. No results are available for an additional 159 acres seeded last fall.

1. Grubbing and burning Artemisia cana failed to kill this species of sagebrush but tended to increase the number of bushes. Such treatment encouraged wind erosion, destroyed valuable reserve feed provided by old stands and has failed in two years to significantly increase herbaceous



vegetation. Burning of this species of sagebrush must be considered as a very questionable rather than a desirable range practice.

2. Density of total vegetation from charting quadrats in 1936 stood at 66, 67, and 69 percent, respectively, of the 1933 totals for overgrazed, moderately and lightly grazed pastures. The slight recovery in density from the low point reached after the 1934 drought may not show up in 1937 because the 1936 drought continued for many months after the charting was completed last July. Practically all seedlings of perennial grasses appearing in 1936 succumbed before the end of the season to retard recovery. Because the slight differences in density trends for three intensities of grazing are still not significant, it must be concluded that drought completely overshadowed intensity of grazing during four years 1934 to 1937, as the cause for this decline. Thus, drought must be considered a major factor in range management.

3. Results from cheap methods of reseeding since 1933 on an aggregate of 1,384 acres to more than 20 species show that crested wheatgrass is by far the most promising for eastern Montana under the worst drought conditions that have occurred there in more than half a century. No results are available for an additional 159 acres seeded last fall.



4. It cannot be said that reseeding to crested wheatgrass is economically justified to the owner of range land of very low productivity when the price of seed is 50 cents or more per pound. With seed at half or less than half of this price, the owner of the better class of range land can well afford to risk 3 to 5 pounds of crested wheatgrass per acre with a 40 percent chance for success in increasing carrying capacity of depleted range land by 100 to 500 percent.

#### FOREST PRODUCTS

1. Average wholesale lumber selling values of Idaho white pine for 1936, increased 12 percent over the 1935 prices. The 1936 price is still 20 percent under the 1926 level. Ponderosa pine prices are only 10 percent under the 1926 level.

2. Lumber manufacturing costs secured for the year 1935, from 24 sawmills of the Inland Empire, indicate a pond to car cost of \$11.73 per M for producing lumber. Detailed cost statistics compiled at the Northern

Rocky Mountain Forest and Range Experiment Station form the basis for the appraisal for sale of practically all federal timber in the Inland Empire.

3. Information of especial interest to timber cruisers was made available during the year, showing for



western white pine trees the percent of gross volume contained in the butt log, second log, and other logs, including the top log. H. Weidman in U.S.D.A. technical bulletin No. 5114. A study at the match block factory of the White Pine Lumber Company resulted in scientific facts forming the basis for grading white pine match plank. Based upon yield of match blocks, plank can be logically segregated into three grades, viz., No. 1, No. 2, and rejects. 5. Service tests conducted in cooperation with the Northern Pacific Railroad have indicated that creosoted western hemlock ties may be expected to give an average of at least 20 to 25 years' service on the main line of this railway system.

6. Service tests conducted on the Lewis and Clark National Forest and near Missoula, Montana, have indicated that creosoted lodgepole pine fence posts may be expected to give an average of 25 years of service. Other tests using zinc chloride have shown that treated cottonwood and ponderosa pine posts are practically all sound after 10 years of service.

#### SILVICS

1. Two major manuscripts appeared in print. "Factors Controlling Initial Establishment of Western White Pine and Associated Species" by I. T. Haig was published



as Yale University School of Forestry bulletin 41. "Timber Growing and Logging Practice in Ponderosa Pine in the Northwest" by R. H. Weidman is U.S.D.A. technical bulletin No. 511, issued in June, 1936.

2. Distinct progress was made in formulating and applying stand improvement measures in the field. In cooperation with Region One, information on stand improvement applicable in the western white pine type was assembled and a stand improvement manual prepared.

3. Summarization of white pine seed production observations made over a number of years brought out the following: Good vigor trees produce from 2 to 7 times the seed of poor vigor trees. In cutover stands good vigor trees become effective seed producers at about 14 inches in diameter, fair vigor trees at about 20 inches. Few poor vigor trees are effective seed producers at any diameter.

4. Study of factors affecting survival in forest plantations brought out: (a) First-year survival of ponderosa pine planting stock with poor roots and tops is from a half to a fourth that of good stock. (b) Extra carefully planted stock averaged 12 percent better survival than comparable stock planted by regular planting crews. (c) The ponderosa pine type makes up nearly half

(47%) of the total forest cover.



5. Marked hereditary differences were found in rate of growth, form, survival, and character of foliage of 25-year-old ponderosa pine grown at the Priest River Branch Station from seed gathered in twenty-two widely separated localities representing the range of the species.

#### FOREST SURVEY

Results of the Forest Survey in the northeastern Washington unit (Spokane, Stevens, and Pend Oreille counties) of the Inland Empire region show that:

(1) Seventy-three percent of the gross area within the unit is still classified as forest land.

(2) Though the timberlands of this unit have been exploited by cutting and fire for over sixty years only 160,253 acres or 6% can now be classified as deforested.

(3) Of the total of 2,643,651 acres of forest lands within the three counties, 517,530 acres or 19.6% still contain stands of sawlog size.

(4) Private industry owns 56% of all the sawtimber stands within the unit.

(5) Ninety-six percent of all producing forest land is classified as being within zones 1 and 2 of three accessibility zones.

(6) The ponderosa pine type makes up nearly half (47%) of the total forest cover.



sulted (7) The average annual rate of depletion by cutting is 301,599 M feet log scale. Sawlogs make up 52% of this use and fuelwood is next with 36%.

(8) The requirements for lumber for new construction and repair on the farms within the unit is 16 million board feet annually. Over half a million fence posts are required annually for replacements and new fences and close to 200 thousand cords of fuelwood are consumed each year. Between June 1 and November 15, a total of 4,300 000

#### MATTERS OF GENERAL INTEREST

During 1936, as in the previous year, emergency funds permitted the construction of much needed improvements at the Priest River Experimental Forest and at the Vigilante Experimental Range. Emergency funds also bolstered up regular funds, which were identical with 1935 allotments, and made possible the continuation of all research projects on the 1935 scale.

#### CIVILIAN CONSERVATION CORPS

The activities of Civilian Conservation Corps workers was centered principally at the Deception Creek and Priest River Experimental Forests. No CCC workers were employed on the Coram Experimental Forest. Only one-third as many workers were available for detail at the various Experiment Stations as in 1935, which re-

for compilation, plot work, and a small amount of improve-



ment work. They proved very satisfactory. During the year from 8 to 9 selected enrollees were used in the Missouri office for computing work with 6 on duty at the present time. Computing work of one of the Station research divisions would be practically at a standstill were it not for this service.

As an example of the use of emergency conservation labor, a brief statement is given of the situation as it existed during the past season on the Deception Creek Forest. Between June 1 and November 12, a total of 4,300 CCC man-days were used on the following activities:

- 50% Forest area improvement
- 39% Stand improvement
- 8% Headquarters improvement
- 3% Plot establishment and vigilance

Forest area improvement consisted principally of the construction of 4 miles of road and 3 miles of roadside cleanup. The principal experimental stand improvement measures consisted of slashing 22 acres of logged-over area in preparation for broadcast burning and pre-disposal of the secondary species (mostly hemlock) on 16 acres of merchantable timber area where the pine was reserved for future sale.

In addition to the foregoing CCC activities, the services of 18 University students enrolled in the CCC and ranging from stenographic services to janitor and watchman services was secured from this source. Crows

various experimental areas. They were used principally for compilation, plot work, and a small amount of improve-



ment work. They proved very satisfactory. During the year from 2 to 8 selected enrollees were used in the Missoula office for computing work with 5 on duty at the present time. Computing work of one of the Station research divisions would be practically at a standstill were it not for this service.

It is unfortunate that CCC work was curtailed instead of expanded during the past year on our various experimental areas. Much remains yet to be done before our improvement plans are completed. For instance, the Deception Creek Forest containing 45 million feet of merchantable timber needs 18 miles of utilization roads. CCC assistance is badly needed at Miles City and Vigilante and other experimental range centers in eastern Montana but so far attempts to locate camps within reach of these areas has been unsuccessful.

#### EMERGENCY RELIEF ADMINISTRATION

Emergency relief funds were used to excellent advantage during the year. The total station allotment for the calendar year 1936 amounted to 517 man-months which is equivalent to \$41,900. Included in this amount is a contribution from Region One of 150 man-months. Assistance ranging from stenographic services to janitor and watchman services was secured from this source. Crews



for field work ranging in size from 5 to 40 men were used at the various field centers of experimental work.

The program carried on at the Deception Creek Experimental Forest is cited as an example of the use of these funds for field work. A crew averaging 25 men was employed continuously from the middle of September to the middle of November, or for a total of 970 man-days. The nature of their work was as follows:

- 60% Forest area improvement
- 36% Stand improvement
- 4% Headquarters improvement work.

The specific work performed under these activities was similar to that of the CCC enrollees covered by the preceding caption.

In addition to the aforementioned \$41,900 ERA allotment, an additional \$5,000 was obtained from State of Montana funds. This was designated as a State W.F.A. project and was used by Range Research on their reseeding project plots located on various National Forests of Montana.

Existing ERA allotments will carry 21 employees now on the payroll until February 28. Estimates for the period March 1 to June 30 were submitted for 260 man-months but only 169 man-months were allotted.



value both to NATIONAL YOUTH ADMINISTRATION Forest Service.  
To meet During the year the University of Montana again offered us the services of undergraduates who were being assisted under the National Youth movement. As many as eight students were used by all Research Divisions of the Station during the year. At the present time six are employed on minor compilation work that fits in with the limited time the students are available. After using this type of assistance for two years it is concluded that (1) as a relief measure to University students the movement is to be commended, (2) satisfactory and effective work commensurate with the pay is rendered.

#### PUBLIC RELATIONS

Great strides have been made during the past two years in the development of physical facilities at our various experimental forests and ranges. The time has come when we should acquaint the public with these various centers of forest research.

A distinct need has been felt for descriptive literature for the Priest River and Deception Creek Experimental Forests. The number of visitors to these Forests has markedly increased during the past year, indicating that these units possess decided demonstration



value both to people in and outside of the Forest Service. To meet this need a descriptive leaflet for general circulation is to be prepared for each experimental forest, giving essential information about the major objectives and work in progress. In addition, for visitors or prospective visitors, a "show me" folder is planned to enable anyone, with or without a guide, to see what is going on and get the major facts regarding specific projects in progress. It is hoped that similar material can be prepared for our range experimental areas.

#### PLANS FOR FISCAL YEAR 1938

In order to give a composite picture of the plans of all research divisions only the high lights of the Station plans are presented under this caption. Less important plans and details of plans for all projects are contained in the status sheets in the supplement.

#### FOREST PROTECTION

1. Continuation of project Pf-2, fire behavior, excepting the lightning phase and expansion to the limit of the altitude and aspect phase of this project.
2. Continuation of study to determine effect of green vegetation on the rate of spread of fire and a test of several field stations of the results to date.



## RANGE RESEARCH

1. Complete improvements for physical setup and new seasonal use project at Vigilante Experimental Range.

2. At Miles City continue (a) cattle range phase of shortgrass range management project, and (b) complete plot establishment and perfect procedure for making permanent records on new sheep range phase of this project.

3. Revise work plan and change artificial reseeding project from a demonstration and extension status to a detailed research basis.

4. Continue efforts to get suitable area for spring-fall experimental range at Rochester Basin, or elsewhere.

## FOREST PRODUCTS

1. Complete all phases of the White Pine Lumber Company study including compilation of final scientific report and publication and distribution of results.

2. Inaugurate studies on one typical white pine and one ponderosa pine operation in order to apply accumulated results of selective logging studies in both forest types.



IMPROVEMENTS - CONSTRUCTION AND MAINTENANCE  
**SILVICS**

**GENERAL CONSTRUCTION**

1. Clean the slate of proposed publications to facilitate final disposition of certain projects.

2. Make a careful and critical review of all silvicultural work and evaluate going projects in order to establish possibilities of expansion into new projects. This should result in a specific restatement of the silvicultural program sometime during the year.

**FOREST SURVEY**

If emergency funds equivalent to 1936 allotments are available the most important jobs planned for are:

1. Completion of the inventory reports for the remaining nine counties of northern Idaho.

2. Complete mapping-in-place of 3 million acres of forest land in western Montana.

3. Field examination for adjustment of private and public cruises collected to date in western Montana. This involves a 10% cruise of about 57,000 sample acres.

4. Make working plan and inaugurate increment study of cedar pole timber in uncut stands.

ment need at the Northern Rocky Mountain Station.

Improvement needs for F.Y. 1938 submitted by our letter of May 16, have been revised by deduction of items



## IMPROVEMENTS - CONSTRUCTION AND MAINTENANCE

### GENERAL CONSTRUCTION

The most outstanding building construction program of the year was carried on at the Priest River Forest. Three major structures were brought to a near stage of completion or completed. A seven-room Superintendent's home, modern in every detail from heated attached garage to the rustic slate rock porches was completed. Another five-room dwelling for the intermittent use of the families of staff members was three-quarters completed and will be ready for occupancy by the beginning of the next field season. Staff members are also about to realize a long cherished hope in the new laboratory and office building that is now four-fifths complete. About three-fourths of the necessary scientific equipment is now installed and by next summer the structure will be completed.

At Vigilante one three-room cottage and a woodshed were completed which are merely a beginning for the development necessary at this experimental center. Completion of the structures recommended in our F.Y. 1939 program for Vigilante and Miles City is the most pressing improvement need at the Northern Rocky Mountain Station.

Improvement needs for F.Y. 1938 submitted by our letter of May 16, have been revised by deduction of items



constructed the past year and in accordance with our present conception of needs. This revision has been incorporated into table 1, which shows improvement construction needs for F.Y. 1939.

### ROAD CONSTRUCTION

Due to the drastic deduction in CCC workers available in 1936 for this work, the accomplishments fell far short of 1935. The present status of road construction and accomplishments during 1936 on the various experimental centers is shown in table 2.

Approximately 40 percent of the proposed roads on the Forests are of a secondary nature and need not be constructed until just prior to logging.

### MAINTENANCE OF IMPROVEMENTS

Estimated improvement maintenance costs are almost identical with those submitted in the last year's annual report. Table 3 indicates annual Station needs.

A continuing annual appropriation over the next five-year period of \$6,500 is needed to maintain the permanent improvements that have been built on the already established experimental forests and ranges.



Table 1.—Improvement construction needs at the Northern Rocky Mountain Forest and Range Experiment Station. Fiscal Year 1939.

Improvement Class	Priest River		Deception Creek		Coram Forest		Ft. Keogh Range		Vigilante Range		Other Areas		Est. cost F.Y. 1939	
	No.:		No.:		No.:		No.:		No.:		No.:		No.:	
	or Total		or Total		or Total		or Total		or Total		or Total		or Total	
	mi.: cost		mi.: cost		mi.: cost		mi.: cost		mi.: cost		mi.: cost		mi.: cost	
Office - laboratories			1	7,500	1	3,000	2	15,500	1	10,000			5	36,000
Residences, 6 or 7-room							1	7,500	1	7,500			2	15,000
"    3 to 5-room	1	3,000			1	4,000							2	7,000
Dormitories	1	4,000	1	4,000	1	1,500	1	3,000	1	3,000			5	15,500
Misc. cabins, 2-room									1	1,000	2	1,500	3	2,500
Mess halls			1	3,000									1	3,000
Garages							1	400	1	1,500			2	1,900
Barns and granaries									1	800			1	800
Shops and storehouses					1	1,000			1	1,000			2	2,000
Gas and oil houses					1	800							1	800
Woodsheds														
Building site improvement	1	500					1	1,100	1	1,700			3	3,300
Cellars (cold rooms)									1	1,000			1	1,000
Water systems					1	1,000			1	3,000			2	4,000
Light plants			1	2,500									1	2,500
Sewage systems					1	1,500							1	1,500
Fire weather tower			1	1,200									1	1,200
Roads			7	18,000	7	14,000			12	6,000			26	38,000
Trails			4	400									4	400
Fences - headquarters														
Range														
Fences									10	2,500			10	2,500
Corrals									3	600			3	600
Water development									3	2,100			3	2,100
Other projects														
Total	3	7,500	16	36,600	14	26,800	8	27,500	38	41,700	2	1,500	79	141,600



Table 2.--Present status and future needs of roads  
on experimental forests and ranges.

Experimental: forests and ranges	Roads: com- pleted: season: 1938	Right-of- way cleared and ready for machine work next season (1937)	Roads con- structed: to date	Total road mileage not constructed: but tenta- tively planned for construction:	Total road mileage. (Sum of columns 4 and 5)
(1)	(2)	(3)	(4)	(5)	(6)
	<u>Miles</u>	<u>Miles</u>	<u>Miles</u>	<u>Miles</u>	<u>Miles</u>
Deception Creek	3.9	0	21.7 <sup>1/</sup>	18.0	39.7
Coram	none	3.9	9.1	49.4	58.5
Priest River	<del>4.7</del>	none.3	22.5	21.0	43.5
Miles City	1.5	0	6.5 <sup>2/</sup>	0	6.5
Vigilante	0	0	0	12.0	12.0
Total	<del>10.1</del>	<del>3.9</del>	59.8	100.4	160.2

<sup>1/</sup> Includes three miles of main line utilization road serving  
Coeur d'Alene National Forest.

<sup>2/</sup> Five and five-tenths miles jointly with Bureau of Animal  
Industry.



# PRINTING REQUIREMENTS

Table 3.--Annual appropriations needed to maintain station improvements.

Class	Average of 5-year period			Annual maintenance
	Miles or number	Unit maintenance cost 1/		
Roads	90	\$ 28		\$ 2,520
Trails	105	8		630
Firebreaks	3	50		150
Buildings	62	31		1,922
Fences	67	6		402
Telephone and power lines	32	11		352
Miscellaneous	18	14		252
Total				\$ 6,228

1/ All labor costs included.

1. A comparison in methods of area estimation on short-grass range. L. Ellison. Journal Agricultural Research. 50 pp. Ms.
2. Observer's bias in selection and measurement of shoots of *Artemisia tridentata*. L. Ellison. Journal Agricultural Research. 45 pp. Ms.
3. Drought--a normal but underestimated element in range management. U.S.D.A. circular. Leon C. Rutt. 70 pp. Ms.



## PRINTING REQUIREMENTS

Following is a statement showing publications intended for formal publication during Fiscal Years 1938 and 1939.

### FISCAL YEAR 1938

1. Effect of low vegetation on rate of spread of fire in the Northern Rocky mountains. George M. Jemison. Journal Agricultural Research. 30 pp. Ms.
2. Natural regeneration in western white pine type. I. T. Haig, R. H. Weidman, K. P. Davis. U.S.D.A. bulletin. 275 pp. Ms.
3. Reproduction on out-over areas in the western white pine type. I. T. Haig and C. A. Wellner. U.S.D.A. bulletin. 130 pp. Ms.
4. Growth of western white pine out-over areas. C. A. Wellner and S. E. Brown. Journal Agricultural Research. 40 pp. Ms.
5. Testing the reliability of height over diameter curves for western white pine. K. P. Davis. Journal Agricultural Research. 10 pp. Ms.
6. Increment of western white pine seed trees left after logging. K. P. Davis. Journal Agricultural Research. 10 pp. Ms.
7. A comparison in methods of area estimation on short-grass range. L. Ellison. Journal Agricultural Research. 50 pp. Ms.
8. Observer's bias in selection and measurement of shoots of Agropyron smithii. L. Ellison. Journal Agricultural Research. 15 pp. Ms.
9. Drought--a normal but underestimated element in range management. U.S.D.A. circular. Leon C. Hurtt. 70 pp. Ms.



Table 4.--Personnel at the Northern Rocky Mountain Forest and Range Experiment Station, January 1, 1937.

# FISCAL YEAR 1939

1. Restoration of depleted range lands of Montana by cheap artificial reseeding methods. Leon C. Hurtt. U.S.D.A. circular. 60 pp. Ms.

## PERSONNEL AT THE NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Most outstanding among personnel developments during the past year was the transfer of Director Watts to Milwaukee as Regional Forester. Watts left the Station the latter part of March and Stephen N. Wyckoff took up the Director's duties in October. M. Bradner served as Acting Director in the interim.

Permanent and temporary personnel at the Station, as of January 1, 1937, are shown in table 4.

Name	Position	Status
Granger W. Branning	Jr. Engineering Draftsman	Appointed
James W. Brian	Asst. Photographer	Unappointed
Thomas E. Brinkley	Jr. Range Examiner	Unappointed
Stewart E. Brown	Junior Forester	Appointed
Jasper H. Buck	Jr. Asst. to Technician	Unappointed
Edward H. Dobrian	Jr. Range Examiner	Unappointed
G. Lloyd Hayes	Technician, Forestry	Appointed
John F. Hays	Assistant Technician	Unappointed
Jess M. Hoesly	Junior Forester	Unappointed
E. Blair Hutchison	Technician, Forestry	Appointed
Orla B. Johnson	Junior Forester	Unappointed
Theodore Kachin	Junior Forester	Appointed
George F. Koskin	Junior Forester	Unappointed
William L. Rorer	Asst. to Technician	Unappointed
Eric G. Brygstad	Junior Forester	Unappointed
Raymond J. Smith	Technical Forest Ranger	Appointed
Edward J. E. Thomsen	Jr. Asst. Foreman	Unappointed
Richard W. Tarkley	Junior Forester	Appointed
Eugene V. Wagner	Jr. Engineering Draftsman	Appointed
Greene Fabian	Clerk	Unappointed
Helen C. Derrick	Jr. Clerk-Stenographer	Appointed
Henrietta A. Piser	Jr. Clerk-Stenographer	Appointed

- 4 G.O.C. Enrollees (Missoula headquarters)  
20 E.R.A. Relief rollere (Missoula headquarters)  
8 N.Y.A. University students (Missoula headquarters)



**Table 4.--Personnel at the Northern Rocky Mountain Forest and Range Experiment Station. January 1, 1937.**

Regular

Stephen N. Wyckoff	Director
Melvin Bradner	Senior Forester
Irvin V. Anderson	Senior Forester
Leon C. Hurtt	Senior Range Examiner
Harry T. Gisborne	Senior Silviculturist
Lloyd G. Hornby	Senior Silviculturist
Robert H. Weidman	Senior Silviculturist
Lincoln Ellison	Associate Range Examiner
Elmer F. Rapraeger	Associate Forester
Chester N. Whitney	Associate Forester
Laurence J. Cummings	Assistant Forester
Kenneth P. Davis	Assistant Silviculturist
John B. Thompson	Assistant Superintendent
E. Joseph Woolfolk	Assistant Superintendent
George M. Jamison	Assistant Forester
Charles A. Wellner	Junior Forester
Mary J. Pershina	Junior Administrative Assistant
Marie E. Bouchard	Assistant Clerk
Norman H. Larsen	Clerk
Dagnar Duncan	Senior Stenographer

Emergency Work (E.C.W.)

<u>Name</u>	<u>Title</u>	<u>Status</u>
Percy N. Pratt	Timber Expert	Appointed
Granger W. Branning	Jr. Engineering Draftsman	Unappointed
James W. Brien	Ass't Photographer	Unappointed
Thomas E. Brierley	Jr. Range Examiner	Appointed
Stewart E. Brown	Junior Forester	Appointed
Jasper M. Buck	Jr. Ass't. to Technician	Unappointed
Edward H. Dobrins	Jr. Range Examiner	Unappointed
G. Lloyd Hayes	Technician, Forestry	Appointed
John F. Hays	Assistant Technician	Unappointed
Jess M. Honeywell	Junior Forester	Unappointed
S. Blair Hutchison	Technician, Forestry	Appointed
Orlo B. Johnson	Junior Forester	Unappointed
Theodore Kachin	Junior Forester	Appointed
George F. Roskie	Junior Forester	Appointed
William L. Royer	Ass't. to Technician	Unappointed
Eric G. Rutquist	Junior Forester	Unappointed
Raymond J. Smith	Principal Forest Ranger	Appointed
Edmund J. S. Throckmorton	Jr. Litho.-Pressman	Unappointed
Richard M. Varney	Junior Forester	Appointed
Eugene V. Wagner	Jr. Engineering Draftsman	Appointed
Grayce Fabatz	Clerk	Unappointed
Helena C. Derrick	Jr. Clerk-Stenographer	Appointed
Henrietta A. Pissot	Jr. Clerk-Stenographer	Appointed

- 4 C.C.C. Enrollees (Missoula headquarters)
- 20 E.R.A. Relief rollers (Missoula headquarters)
- 8 N.Y.A. University students (Missoula headquarters)



## PERSONNEL TRAINING

Personnel training efforts within the Station have consisted largely of statistical seminars conducted by staff members who have received statistical training in Washington. Practically all technical members of the staff have taken such training at one time or another. New student assistants at the various experimental centers are put through a rather extensive course of training at the beginning of the field season. A more definite plan for this type of training should be developed. Cruising schools have also been conducted at various times for new recruits on the Survey and consisted only of specific instruction on the job to be performed under office and field conditions.

It is felt that Station staff members should participate in the training of the National Forest personnel, particularly recruits and key men in various activities. The Division of Fire Research has conducted a very successful school attended by key fire control men in Region One. It is felt that this is a regular part of the Station work and should be expanded under an organized program designed to disseminate research results of all lines of work to the administrative forces.



## FINANCES

Expenditures for F.Y. 1937 are shown in table 5.

### OUTSTANDING FINANCIAL NEEDS AT THE NORTHERN ROCKY MOUNTAIN STATION.

Some of the highlights in financial needs of the  
Station by Divisions are as follows:

#### Forest Protection

1. Additional allotments of \$10,000 to continue  
three phases of Hornby's fire control planning project, as  
follows:

- (a) Analysis of Region One fire reports.
- (b) Detection facilities and methods.
- (c) Initial attack.

Will be used largely for salaries and expenses of new per-  
sonnel--two new positions, one P-4 grade and one P-2 grade.

#### Range Research

1. New allotment of \$15,000 for artificial reseed-  
ing to supplement emergency funds used heretofore. Will  
be used for two new positions (one P-3 and one P-2) and  
15 man-months of temporary assistants.

2. Need \$15,000 for seasonal use study at Vigilante  
Range. Used for salaries and expense of two new positions  
(one P-3 and one P-2) and 12 man-months of temporary assist-  
ants.



Table 5.--

(Estimated) EXPENDITURES F.Y. 1937

Lines of Work	Regular			Emergency Funds			Regional
	Research	Coop.		Nira	ECW	ERA	Office ERA
	Funds	Work					Contribution
<b>Forest Management</b>							
Management - White Pine	\$ 5,084.55	\$1,828.16	\$		\$ 2,382.91	\$ 3,100.02	\$ 2,438.81
Thinning - " "	725.31				359.01	238.90	
Management - Ponderosa Pine	72.15				38.29		
Thinning - " "	73.14				33.04	49.53	
Mensuration- White Pine	2,252.84				1,113.08	512.13	
" - Ponderosa Pine	124.80				46.27		
" - Larch-Douglas Fir	461.75				211.52	51.96	103.16
Regeneration - Botany	939.70				429.65		
" - Forestation	5,290.76				2,406.23	347.46	3,662.98
Protection - Attack	3,922.61				1,890.61	8.37	
" - Behavior	9,445.73			75.00	4,483.54	10,891.63	745.75
Special Studies	256.66				125.85		
<b>TOTAL</b>	<b>28,650.00</b>	<b>1,828.16</b>	<b>75.00</b>	<b>13,500.00</b>	<b>15,000.00</b>	<b>6,950.70</b>	
<b>Range Investigations</b>							
Management - Shortgrass Ranges	13,928.02				806.76	5,269.12	2,568.82
" - Summer Ranges	3,696.33				581.71	8,977.32	4,930.25
Artificial Reseeding	6,675.65				611.53	253.56	100.00
<b>TOTAL</b>	<b>24,300.00</b>				<b>2,000.00</b>	<b>14,800.00</b>	<b>7,599.07</b>
<b>Forest Economics</b>							
Forest Survey - Idaho	13,680.04				18,233.51	5,359.63	1,150.00
" " - Montana	3,841.53			200.22	7,143.69	1,645.21	400.00
" " - Washington	2,478.43				3,622.60	1,421.23	405.55
<b>TOTAL</b>	<b>20,000.00</b>		<b>200.22</b>	<b>29,000.00</b>	<b>8,426.07</b>	<b>1,955.55</b>	
<b>Forest Products</b>							
Logging & Milling Studies	7,716.87						26.77
Species Utilization	28.08						
Woods & Mill Utilization	281.28						
Statistics	3,013.32	650.00				132.61	117.35
Wood Preservation	810.45						
<b>TOTAL</b>	<b>11,850.00</b>	<b>650.00</b>				<b>132.61</b>	<b>144.12</b>



**Table. 6.--Allotment sheet Fiscal Year 1938**

(This table will be submitted soon after 1938  
allotments are received.)

(This table will be submitted soon after 1938  
allotments are received.)



### Forest Products

Table. 7.--Estimated distribution of direct and overhead expenditures, Northern Rocky Mountain Station, Fiscal Year 1938.

to finance present positions in Products and contribute pro-rata share to Station overhead.

\$12,500	present salary obligations
1,100	travel expenses
400	field assistants
550	other
<u>8,100</u>	station overhead

(This table will be submitted soon after 1938 allotments are received.)

### Silvics

1. Need \$9,500 additional funds to finance Forestation project to study

(1) Factors affecting low survival in field planting.

(2) Direct seeding.

(3) Brush field planting and seeding.

2. Allotment of \$3,500 to finance year-round work at Deception Creek Experimental Forest in P-2 grade.

### Forest Survey

1. An annual appropriation of \$150,000 to complete the survey for the Northern Rocky Mountain region in two years.

2. An annual appropriation of \$70,000 to complete the survey in four years.



## McNARY-McNARY ACT COOPERATION

### Forest Products

1. Need a minimum of \$5,500 additional allotment to finance present positions in Products and contribute pro-rata share to Station overhead.

our more important needs are:

\$12,680	present salary obligations
1,100	travel expense of Plant Industry,
600	field assistants
650	other
<u>2,100</u>	<u>station overhead</u>

\$17,130 needed. Now available \$11,600.

### Silvics

1. Need \$9,600 additional funds to finance forestation project to study

(1) Factors affecting low survival in field planting.

(2) Direct seeding.

(3) Brush field planting and seeding.

2. Allotment of \$3,200 to finance year-round man at Deception Creek Experimental Forest in P-2 grade.

### Forest Survey

1. An annual appropriation of \$150,000 to complete the survey for the Northern Rocky Mountain region in two years.

2. An annual appropriation of \$70,000 to complete the survey in four years.



### McSWEENEY-McNARY ACT COOPERATION

The need for cooperative assistance under the McSweeney-McNary Act, expressed in last year's report, is again presented for consideration in summary form. Briefly, our more important needs are:

1. Pathologist from Bureau of Plant Industry, needed in the study of control of blister rust in the white pine type. Stem and root rots in white pine stands are particularly aggravating problems in the management of this type.
2. Biologist from the Biological Survey, needed to study (1) influence of rodents on regeneration in principal forest types and ranges of the Region, and (2) wild life management problems.
3. Soils chemist to determine chemical and biological limits of soil disturbance permissible under forest and range management.



P A R T

T W O

STATUS SHEETS BY LINES OF WORK



**FINANCIAL  
PROJECT:**

Forest Management Investigations.

**WORK  
PROJECT:**

Fire Protection Investigations.

**RESEARCH  
PROJECT:**

FF-2. Behavior. Measuring the daily and seasonal variables of fire danger.

**WORKING  
PLANS:**

Plan dated May 18, 1928, by H. T. Gistorns.

**SCOPE:**

1. Cooperation with Weather Bureau in fire-weather forecasting.

2. Light **STATUS SHEETS** of forest fires.

3. (a) Developing methods of measuring fuel moisture.

**FOREST PROTECTION**

(b) Determining the effects of each of the weather elements on fuel moisture.

(c) Correlating fuel moisture with inflammability and fire behavior.

(d) Determining effect of condition of green vegetation on rate of spread of fire.

(e) Determining differences in fire danger factors according to amount of shade, elevation, and north vs. south slopes.

(f) Integrating all factors of fire danger.

4. Supplying instruments and supervising the operation of all stations using the Northern Rocky Mountain methods of measuring forest fire danger.



**FINANCIAL  
PROJECT:**

Forest Management Investigations.

**WORK**

**PROJECT:**

Fire Protection Investigations.

**RESEARCH  
PROJECT:**

Pf-2. Behavior. Measuring the daily and seasonal variables of fire danger.

**WORKING  
PLANS:**

Plan dated May 18, 1922, by H. T. Gisborne.

**SCOPE:**

1. Cooperation with Weather Bureau in fire-weather forecasting.
2. Lightning as a cause of forest fires.
3. (a) Developing methods of measuring fuel moisture.  
(b) Determining the effects of each of the weather elements on fuel moisture.  
(c) Correlating fuel moisture with inflammability and fire behavior.  
(d) Determining effect of condition of green vegetation on rate of spread of fire.  
(e) Determining differences in fire danger factors according to amount of shade, elevation, and north vs. south slopes.  
(f) Integrating all factors of fire danger.
4. Supplying instruments and supervising the operation of all stations using the Northern Rocky Mountain methods of measuring forest fire danger.



STATUS:

1. Continued on same basis as in past by field

2. Report on analysis of 10 years of records untouched during past year. Test of Thyrite insulators turned over to Regional Communications Engineer.

3. (a) Continued tests of present methods.

(b) Another season's data added to records

(c) for later analysis. also used by Regional

(d) Two tests each employing six plot fires,

made primarily for phase (d), but data

also useful in phase (c). to phase (d),

(d) See separate status sheet. to (a) and (f),

and (e) See separate status sheet. cylinders

and (f) Data from phases (d) and (e) used. at

4. Wood cylinders or duff hygrometers recalibrated and furnished to 84 Forest Service stations in

Region One, 13 in Region Four, 1 in Region Nine,

9 to the National Park Service, and 10 to the

Indian Service, making a total of 117 stations

using 100 sets of wood cylinders and 32 duff

hygrometers. Eleven of these were new stations

established on the eastern Montana Forests at

the request of the Regional Forester.



FINANCIAL  
PROJECT:  
RESULTS:

1. Fire-weather forecasts again rated by field men as very good.

WORK  
PROJECT:

2. No work done.

RESEARCH  
PROJECT:

3. (a) Nothing new.

PLANS  
WORKING  
PLANS:

(b) Nothing new.

(c) Nothing new.

(d and e) See separate status sheets.

(f) Ratings for 1936 season used by Regional

Office and accepted as satisfactory.

PLANS  
F.Y.  
1938:

Continue all phases except 2.

Give majority of effort by Jemison to phase (d), by Hayes to phase (e), by Gisborne to (a) and (f), and by Kachin to calibration of wood cylinders and duff hygrometers. Hold a training school at

STATUS:

Priest River to be attended by one or more men from each Forest. Gisborne to inspect methods of assembling and using data in all Supervisor's offices during July and August. Prepare to adopt improved danger meter in 1938.

ASSIGN-  
MENT:

Gisborne for project as a whole, Jemison for phase (d), and Hayes for phase (e).

project for a three-month summer period. In addition to the unpublished progress report written as a thesis by Jemison while at Yale



FINANCIAL  
PROJECT:

during the winter of 1935-1936, a report and  
Forest Management Investigations.  
revision of the working plan are being prepared

WORK  
PROJECT:

Fire Protection Investigations. will be made for

RESEARCH  
PROJECT:

continuing the study at least two more years.  
Pf-2. Phase (d). Vegetation.

RESULTS:  
WORKING  
PLANS:

Fundamental chemical investigations have

Plan dated April 17, 1934, by Harry T. Gisborne.

Plan revised March 19, 1935, by George M. Jemison.

Plan revised February 8, 1936, by George M. Jemison.

Plan revised February 11, 1937, by George M. Jemison.

Effect of grasses, weeds, and shrubby

vegetation on the rate of spread of fire.

SCOPE:

To determine the effects of vegetation on  
the rate of spread of fire and to develop methods  
of measuring this effect so that the daily rating  
of fire danger may be properly modified.

STATUS:

Field work has been conducted at the Priest  
River Branch as planned (working plan and revi-  
sions on file in Washington Office) during the  
summers of 1934, 1935, and 1936. About half of  
Jemison's time from June to December, 1936, has  
been spent on this study. Several helpers, in-  
cluding a chemist, gave their full time to the  
project for a three-month summer period. In  
addition to the unpublished progress report  
written as a thesis by Jemison while at Yale



during the winter of 1935-1936, a report and revision of the working plan are being prepared at present and recommendations will be made for continuing the study at least two more years.

RESULTS:

F.Y.  
1938:

Fundamental chemical investigations have shown that the variable water content exerts a greater effect on fire-readiness of vegetation than does the chemical constitution. Furthermore, the manner in which this water is held by plant tissues and plant solutions is significant.

New data on volume and condition of vegetation and their effects on fire behavior permitted a tentative revision of the fire danger meter by using cumulative temperature as an index of fire-readiness of vegetation. This index was first superimposed on calendar date. It was then found that the temperature summation is also an index of the drying of north slopes, timbered areas, and heavy fuels. Calendar date was therefore supplanted by the temperature index except for retention of date for a September step-down in danger due to pronounced effect of long nights. The revised meter rates danger slightly higher than the standard meter through a short early



FINANCIAL  
PROJECT:

WORK  
PROJECT:

RESEARCH  
PROJECT:

PLANS  
F.Y.  
1938:

WORKING  
PLANS:

SCOPE:

STATUS:

ASSIGN-  
MENT:

spring period, lower through early and mid-summer,  
and higher in late summer and through the fall  
until September rains occur at which point the  
rating drops below that of the regular meter.

Continue all phases of the study at the and  
Priest River Branch with particular emphasis on  
burning tests to determine fire-readiness of  
vegetation. Arrange for vegetation samples to  
be collected monthly at seven selected stations  
in other parts of the Region from which moisture  
content may be determined. Test the "seasonal  
index" meter thoroughly and critically at a few  
selected stations throughout the Region during  
1937.

George M. Jamison.

have been obtained from eight inflammability sta-  
tions which are located in pairs on the north and  
south sides of a ridge at elevations of 2500, 2700, 2800, and 3000 feet. Continuous records of  
temperature, relative humidity, leaf moisture, and  
one-half inch wood moisture, and wind are obtained  
with recording instruments at each station. The  
records of the latter three elements are obtained  
with fuel hygrometers which were developed es-  
pecially for this project. Hayes devoted over  
half of his time from April to November to this  
project with field assistance by Kashin. Buck



FINANCIAL  
PROJECT:

Forest Management Investigations.

WORK  
PROJECT:

Fire Protection Investigations.

RESEARCH  
PROJECT:

Pf-2. Behavior. Measuring the daily and seasonal variables of fire danger--phase (c) altitude and aspect study.

WORKING  
PLANS:

Plan in course of preparation by G. Lloyd Hayes.

SCOPE:

Determining the differences in the elements of fire danger at different elevations on north and south slopes.

STATUS:

Two seasons of complete and reliable records have been obtained from eight inflammability stations which are located in pairs on the north and south sides of a ridge at elevations of 2300, at 2700, 3800, and 5500 feet. Continuous records of temperature, relative humidity, duff moisture, season. one-half inch wood moisture, and wind are obtained with recording instruments at each station. The records of the latter three elements are obtained with fuel hygrographs which were developed especially for this project. Hayes devoted over half of his time from April to November to this project with field assistance by Kachin. Buck



and three CCC assistants were used for current compilation of data. The preliminary working plan is being revised.

RESULTS: Analysis of data have revealed the following:

- (1) Temperature reaches its daily maximum and relative humidity its daily minimum on the valley floor, but the highest 24-hour average temperature, and the lowest 24-hour average relative humidity occur about 1000 feet higher up the slopes.
- (2) Duff moisture on the south slopes generally reaches about the same minimum at all elevations with a slight tendency to be less at high elevations. On north slopes the lowest duff moistures occur at low elevations in early season and at middle elevations during mid and late season.
- (3) Minimum one-half inch wood moisture occurs near the valley floor in early season, but moves up to mid-elevations as the fire season develops. Unsettled weather in the fall moves it back near the valley floor. It is generally a little less on south than on north slopes.



FINANCIAL  
PLANS:  
F.Y.  
1938:  
PROJECT:  
RESEARCH  
PROJECT:  
WORKING  
PLANS:  
SCOPE:

(4) The lowest 24-hour average fuel moisture content is found about 1000 feet up the mountain from the valley floor. This average fuel moisture increases equally with an ascent of 2000 feet to higher altitudes. At least one more pair of stations is needed at the 3000 foot level, 10 more accurate hygrothermographs are needed, a complete transect of a 2000-foot deep valley should be made to determine conditions half way down both north and south slopes.

and (5) Wind velocity increases with elevation and is usually higher on south than on north slopes.

ASSIGN-  
MENT:

(6) Maximum fire danger tends to be the same at all elevations in early and late season but during the peak of the season is decidedly greater above 3000 feet elevation than below it. Fire danger is greater on south slopes than on north slopes.

STATUS:

(7) The beginning and ending of a fire season are characterized by marked differences in fire danger between north and south slopes, by altitude, and by hours of the day. Decreases of these differences characterize the peak of a fire season, and apparently distinguish the critical from the easy season.



FINANCIAL

PLANS:

F.Y.

1938:

PROJECT:

RESEARCH

PROJECT:

WORKING

PLANS:

SCOPE:

ASSIGN-

MENT:

Continue this study of the basic features of fire danger to the limit of available funds.

At least one more pair of stations is needed at the 3200 foot level, 10 more accurate hygrothermographs are needed, a complete transect of a 2000-foot deep valley should be made to determine conditions half way down both north and south slopes, and at their bases. All results for this particular ridge should be checked by a similar investigation in another part of the Region and with a greater altitudinal range.

G. Lloyd Hayes.

STATUS:

(a) Completed for 1921-1930. All fire reports for 1931-1938 coded, punch carded, and ready for analysis.

(b) Completed and results already in routine use except for (1) perfection and test of two forms of visibility meter, and



FINANCIAL PROJECT: (2) a study of stationary versus moving Forest Management Investigations.

WORK PROJECT: (1) Fire Protection Investigations. work needed to determine actual rates of spread and rates of half-line construction in all fuel types.

RESEARCH PROJECT: Pf-1. Attack. Fire control planning.

WORKING PLANS: No plan (except status sheets) ever prepared.

SCOPE: (a) Analysis of Region One fire reports. admin-  
 (b) Detection facilities and methods, location of stations.  
 (c) Initial attack on fires. Placement of men, speed and strength of attack by fuel types.  
 (d) Reinforcement. Speed and strength requirements by fuel types. Roads and trails needed.  
 (e) Preparation of plans by Forests so that standards of protection will be achieved equitably.  
 (f) Use of chemicals in fire control.

RESULTS: (a-e) The methods evolved by this research have been applied to the Northern Rocky Mountain Region which summarizes this work is being used as a guide. It is being transferred to the Washington Office to head up this work. This report is also covered by many Forest

STATUS: (a) Completed for 1921-1930. All fire reports for 1931-1936 coded, punch carded, and ready for analysis.  
 (b) Completed and results already in routine use except for (1) perfection and test of two forms of visibility meter, and of nation-wide value.



Part (2) a study of stationary versus moving  
Album" detectors, and containing illustrations as  
(c&d) Results in use but further work needed to  
determine actual rates of spread and rates  
of held-line construction in all fuel types.  
(e) This phase to be taken over by Regional Office

PLANS  
F.Y.  
1938:

Thereof fire control as it is now purely admin-  
phases (administrative. (c) but funds and personnel

ASSIGN-  
MENT:

(f) No field tests done since 1935. Cooperating  
with Foamite Company in construction of  
Osborne to provide general supervision.  
a back-pack chemical engine.

RESULTS: (a-e) The methods evolved by this research have  
been applied on ten National Forests comprising  
more than 17 million acres. The effects have been  
so beneficial that similar methods are now to be  
applied to all the National Forests throughout  
the United States. Hornby's progress report,  
"Fire Control Planning in the Northern Rocky  
Mountain Region" which summarizes this work is  
being used as a guide. Hornby is being transferred  
to the Washington Office to head up this work.  
This report is also demanded by many Forest  
Schools as a basis for teaching these advanced  
methods. This is an outstanding example of  
localized research in methodology proving to be  
of nation-wide value.



During 1936, fifteen copies of a "Fuel Type Album" were prepared containing illustrations as well as descriptions of each type now recognized. These were necessary in order to maintain uniformity of fuel type checking and classification on the fire forests of Region One.

PLANS  
F.Y.  
1938:

There is urgent need of additional work on phases (a), (b), and (c) but funds and personnel are completely lacking.

ASSIGN-  
MENT:

Gisborne to provide general supervision.



**FINANCIAL  
PROJECT:**

Range Investigations

**WORK**

**PROJECT:**

Operating Management Investigations

**RESEARCH  
PROJECT:**

Management Shortgrass Ranges (Cattle and Sheep Phases) working plan for cattle range phase prepared by Hartt in 1933, revised April 11, 1935. Approved by Chapline, June 19, 1935. Supplements added July 21, 1935 and April 6, 1936.

**WORKING  
PLANS:**

The working plan for sheep range phase by Hartt is **STATUS SHEETS** 1936, and oral approval by Chapline is indicated by office letter of June 15, 1936. A major revision may be necessary if severe **RANGE RESEARCH** conditions continue through 1937.

**SCOPE:**

To determine correct management and utilization practices for **STATUS SHEETS** shortgrass ranges, typical of southwestern Montana from the standpoint of vegetation, but with full recognition of the economies of livestock production. Work has been under way since 1932 for cattle range and since early 1934 for sheep range.

**STATUS:**

A. Sheep Range 1934.

The pasture fences and physical set-up for sheep range studies was completed early in 1936. As a result of developing reservoirs and



**FINANCIAL  
PROJECT:**

Sheep late last summer; this formerly dry range  
Range Investigations  
is one of the best watered areas at the U. S.

**WORK  
PROJECT:**

Grazing Management Investigations

**RESEARCH  
PROJECT:**

Records were started in June, 1933, when 30  
Management Shortgrass Ranges (Cattle and  
yearling ewes were turned into each of these five  
Sheep Phases) working plan for cattle range phase  
pastures designed to show the effects of grazing  
prepared by Hurtt in 1932, revised April 11, 1933.  
at five intensive districts in grazing steps.  
Approved by Chapline, June 19, 1933. Supplements  
The series of plots planned to measure effects  
added July 21, 1933 and April 8, 1936.

**WORKING  
PLANS:**

The working plan for sheep range phase by  
and production of range for sheep was actually  
Hurtt is dated April 8, 1936, and oral approval  
established because the vegetation and the vegeta-  
tion is very bad condition for sheep range phase  
by Chapline is indicated by office letter of  
June 16, 1936. A major revision may be necessary  
if severe coyote depredations continue through  
the spring of 1937.  
1937.

**SCOPE:**

To determine correct management and utiliza-  
tion practices for yearlong shortgrass ranges,  
typical of southeastern Montana from the stand-  
point of vegetation, but with full recognition  
of the economics of livestock production. Work  
has been under way since 1932 for cattle range  
and since early 1936 for sheep range.

**STATUS:**

A. Sheep Range Phase.

The pasture fences and physical set-up  
for sheep range studies was completed early in  
1936. As a result of developing reservoirs and  
hoppers located in the area.



seeps late last summer, this formerly dry range is one of the best watered areas at the U. S. Range Livestock Experiment Station. Grazing records were started in June, 1936, when 35 yearling ewes were turned into each of these five pastures designed to show the effects of grazing at five intensities differing by regular steps. The series of plots planned to measure effects of such grazing intensities on density, vigor, and production of range forage were not actually established because the drought had put the vegetation in very bad condition for such work. These plots must be established and records started in the spring of 1937.

**B. Cattle Range Phase.** Extreme drought conditions similar to those of 1934 again interfered with the normal course of this experiment on both cattle and sheep ranges. Grazing at three intensities was continued on the six winter and six summer pastures with 10 cows to each replicated pasture. Hay feeding started in July but the cattle had to be removed from the pastures in August.

Quadrats on cattle ranges were charted to detect changes in density. Drought and grasshoppers interfered considerably with measurements



on other plots established to show differences in vigor, production, etc., as influenced by intensity of use. Snow came before some of the plots were clipped. A special effort was made to collect data showing establishment and survival of native range grass seedlings following the big die-off resulting from the 1934 drought.

RESULTS:

A. Sheep Range Phase.

Because of inability to get plots established on the sheep pastures, there are no records of vegetation density, vigor, or production to report. Grasshoppers were slightly less abundant on these ranges than elsewhere but as an estimate they, coupled with drought, reduced forage on these pastures to 30 to 40 percent of that available during 1935.

The sheep were carried without supplemental feed from June 13 to October 31, but the range feed was deficient to produce satisfactory gains. Frequent disturbance by predators was doubtless one reason for unsatisfactory gains of these sheep though drought is considered the more important cause.

Weight data began on June 13 and continued at 4-week intervals until October 31, when the



pasture test was discontinued because of drought conditions and abnormal predator depreciations.

#### B. Cattle Range Phase.

Extremely unfavorable weather conditions also interfered materially with the normal course of this experiment. This is indicated by the fact that density of all important forage species except one has declined materially on all pastures. In 1936 the density of all vegetation on the overgrazed, moderately, and lightly grazed pastures was 66, 67, and 68 percent, respectively, of the 1933 densities.

The slight recovery in density from the low point reached after the 1934 drought may not be evident in 1937 because the 1936 drought continued for many months after the charting was completed last July. Practically all seedlings of perennial grasses appearing in 1936 succumbed before the end of the season, to retard recovery. Because the slight differences in density trends for three intensities of grazing are still not significant, it must be concluded that drought completely over-shadows intensity of grazing during the four years as the cause for this decline. Thus, drought must be considered a major factor in range management.



On the other hand, the cost of feed per pound of weaning calf weight produced averaged for the four years 6.21, 3.87 and 4.31 cents, respectively, for overgrazed, moderately, and lightly grazed ranges. These differences show only a portion of the economic penalties of overgrazing because such items as reduced value of poorly developed calves, greater deterioration of cows and increased risks are not included.

Considering all these factors, it is evident that approximately 32 acres of such range per cow gives cheaper and more stable production than where only approximately 23 acres are allowed as is the usual practice.

Grubbing and burning Artemisia cana failed to kill this species of sagebrush but tended to increase the number of bushes. Such treatment encouraged wind erosion, destroyed valuable reserve feed provided by old stands and has failed in two years to significantly increase herbaceous vegetation.

PLANS  
F. Y.  
1938:

The plot setup for comprehensive records on behavior of vegetation on sheep ranges will be completed as rapidly as possible and revisions made in the working plan as required. Pasture tests will be started again about May 1, and



FINANCIAL  
PROJECT:

Range Investigations.

WORK  
PROJECT:

special efforts will be made to prevent losses from coyotes. Work along present lines will be

RESEARCH  
PROJECT:

continued on the cattle range project. Efforts

WORKING  
PLANS:

to improve ecological methods for measuring plant vigor, clipping technique, etc., will be continued as outlined in the Methods of Study subproject.

SCOPE:

A new lot of 80 heifers, 2's next spring, will be furnished by the Bureau of Animal Industry to replace the cows that were turned back last fall. These cows would have been 7 years old this spring, too old to complete a 10-year test.

ASSIGN-  
MENT:

Leon C. Hurtt, Lincoln Ellison, and E. J. Woolfolk, in cooperation with the Bureau of Animal Industry at the U. S. Range Livestock Experiment Station.

Lack of regular funds and uncertainty as to duration of emergency funds has dictated that this work should be carried primarily as an extension or demonstration rather than as a detailed research basis. This is far from satisfactory. Detailed research should be initiated without entirely neglecting extension and demonstration phases.



FINANCIAL  
PROJECT:

Range Investigations.

WORK  
PROJECT:

Artificial Range Reseeding Investigations.

RESEARCH  
PROJECT:

Artificial Range Reseeding.

WORKING  
PLANS:

Preliminary plan and letter to Washington dated March 21, 1936, by L. C. Hurtt. No formal approval.

SCOPE:

To find effective cheap methods, the most promising species and mixtures, and the comparative grazing value of each for reseeding range land that has been depleted by plowing or otherwise, and to determine soil or other limitations to successful reseeding.

STATUS:

This project, started in 1933 with emergency funds, has since continued, but on a somewhat diminished scale in 1936, because of the reduction in E.C.W. allocation for the past year. Lack of regular funds and uncertainty as to duration of emergency funds has dictated that this work should be carried primarily on an extension or demonstration rather than as a detailed research basis. This is far from satisfactory.

RESULTS:

Detailed research should be initiated without entirely neglecting extension and demonstration phases.



No results can be given yet for the 159 acres reseeded in the fall of 1936, including approximately 92 acres on the Absaroka, Beaverhead, Cabinet, and Lolo National Forests, 30 acres at the U. S. Range Livestock Experiment Station, and 37 acres on private lands under cooperative agreements.

Exclusive of this 159 acres, a total of approximately 1384 acres have been reseeded since 1933, of which about 120 acres were on five National Forests, 182 acres at the U. S. Range Livestock Experiment Station, and 1082 acres on approximately fifty cooperative areas in twenty-five Montana counties. Both fall and spring seedings have been made under a wide variety of soil conditions and varying methods and degrees of soil preparation for each of the numerous species and mixtures.

Plans for testing grazing capacity of crested wheatgrass in comparison with native range were again deferred because of failure to secure a satisfactory stand on the test area.

#### RESULTS:

Without doubt the past three years, including two of the worst droughts of record, have been the most unfavorable periods for reseeded work in Montana during the past 50 years or more.



Grasshoppers and Mormon crickets have also been a major handicap to successful reseeding. In spite of this situation some encouraging results have been obtained.

Results from cheap methods of reseeding on an aggregate of 1,384 acres since 1933 to more than 20 species show that crested wheatgrass is by far the most promising for eastern Montana under the worst drought conditions that have occurred there in more than half a century. No results are available for an additional 159 acres seeded last fall.

Fall seeding on 378 acres with 41 percent success has given consistently better results for crested wheatgrass than spring seeding on 507 acres with only 30½ percent success. Smooth brome grass, slender wheatgrass, and mixtures gave successful stands on 19, 16, and 18 percent of the acreage seeded in the fall and 15, 16, and 13 percent, respectively, for spring seeding. Less acreage was seeded to these than to crested wheatgrass. Even these low percentage figures warrant further trials with these latter and certain other species under more favorable conditions.

It cannot be said that reseeding to crested wheatgrass is economically justified to the owner



of range land of very low productivity when the price of seed is 50 cents or more per pound. With seed at half this price, or less, the owner of the better class of range land can well afford to risk 3 to 5 pounds of crested wheatgrass per acre with a 40 percent chance for success in increasing carrying capacity of depleted range land by 100 to 500 percent.

PLANS  
F. Y.  
1938:

Few or no additional demonstration areas are planned for private land, although some agency should continue and intensify this extension type of work. Further detailed examinations should be made in 1937 of all areas already covered and the new deep-furrow type drill should be thoroughly tested out at Miles City and possibly on some cooperative areas that have been unsuccessful.

The search for cheap methods of reseeding on rocky, brushy and steep sites on National Forests, where drills are not usable, should be continued. A survey to determine location and extent of areas in need of artificial reseeding on National Forests should be started in 1937.

Deeper seeding with nurse crop to assist weak grasses should be tested more fully, especially on heavy soil likely to crust or "bake" after showers.



A preliminary working plan was prepared and submitted to Washington in the spring of 1936. This plan proposed to investigate in detail the best time and rate of seeding, and depth of cover, largely under controlled conditions and replicated plots. This plan should be somewhat revised and amplified to embrace an investigation of deficiencies in organic matter, available phosphorus, calcium and possibly nitrogen and potash content of soils that may materially influence the chances for successful reseeding. Preliminary exploratory work has been started by the recent analyses of 74 soil samples from four widely separated reseeding areas. Of these, 41 or 55 percent showed a moderate to high deficiency of available phosphorus and four samples showed a deficiency of potash. Organic matter content on one National Forest area was less than half that on two abandoned fields. Further work of this kind is needed.

Also the whole question of fertilization of ranges is one that should be investigated without undue delay even though there may now be definite limitations to the use of fertilizers on the range.



FINANCIAL  
PROJECT:

WORK  
PROJECT:

RESEARCH  
PROJECT:

WORKING  
PLANS:

ASSIGN-  
MENT:

SCOPE:

STATUS:

While crested wheatgrass has been most successful so far, the search for other species and particularly for mixtures that are so desirable, as compared to pure stands, should be intensified and extended.

A regular allotment of \$15,000 would permit employment of an Associate in addition to the Assistant grade man and the initiation of reseeding work on an effective research basis. This cannot be done within the limitations imposed by emergency funds.

April Leon C. Hurtt, with new Associate grade man capable of handling soil analysis work, and L. R. Short with such assistance as E. J. Woolfolk can give at Miles City.

1. As a subject under the shortgrass and summer range management projects, evaluation of adequacy of the ecological methods now used in range studies.
2. The devising of improvements in methods and procedures, and the testing of new methods especially for shortgrass types, bunchgrass types and brush types.

Except for a little preliminary work in 1933, 1934 is the first year in which special attention has been given to methods. Most emphasis was placed on methods of intensive density



**FINANCIAL  
PROJECT:**

Range Investigations.

**WORK  
PROJECT:**

Grazing Management Investigations.

**RESEARCH  
PROJECT:**

Management Shortgrass and Summer Ranges.  
Methods in Plant Ecology.

**WORKING  
PLANS:**

Under designation RR-NRM, Methods,  
Quadrat Charting, "Preliminary working plan -  
comparison of methods". L. Ellison. April 21,  
1936. Not in Washington Office files.

**RESULTS:**

Under designation RR-NRM, Plant Develop-  
ment, "Supplement to working plan". L. Ellison.  
April 18, 1936. Not in Washington Office files.

Working plan for field season of 1937 is  
not yet prepared as analysis of 1936 data is  
still incomplete.

**SCOPE:**

1. As a subproject under the shortgrass  
and summer range management projects, evaluation  
of adequacy of the ecological methods now used  
in range studies.

2. The devising of improvements in  
methods and procedures, and the testing of new  
methods separately for shortgrass types, bunch-  
grass types and brush types.

**STATUS:**

Except for a little preliminary work in  
1935, 1936 is the first year in which special  
attention has been given to methods. Most em-  
phasis was placed on methods of intensive density



estimation. Study was given also to sampling problems in comparisons of pastures, and to the insuring of true random selection in making height measurements of grass. None of these studies is through the analysis stage as yet. The first and last mentioned will probably warrant publication, and it is hoped the data can be analyzed and the manuscripts prepared by spring.

#### RESULTS:

On shortgrass quadrats, ranging in type from sparse grama grass to dense matted buffalo grass cover, three methods of estimation were used in such a way that method could be compared with method and observer with observer on the basis of the variations in replications by each man. Because of drought, artificial watering to keep the grass green and shading of the ground by screening against grasshoppers made the density of vegetation fluctuate considerably during the test period--much more than had been anticipated--and so complicated the comparisons. From the incomplete analyses, the pantograph-chart method is: (1) consistently higher than the others, (2) with high density and poorly defined clumps, least dependable, and (3) most costly--at the least 4 to 5 times as expensive as the other two in point of time. The square decimeter estimate



method and the point-analysis method are apparently of similar accuracy but in their present application neither is free enough from subjective error to be satisfactory. Fortunately, both are capable of further mechanical improvement. Subject error is, however, present in all three methods, but with point-analysis error should be nil, theoretically, but actually it is a quantity to be reckoned with. Sampling studies have demonstrated the general principle that adjacent plots are more alike than distant ones and that series of paired plots, in spite of definite limitations, are the most practicable means we have for pasture comparisons until such time as we can judge comparability with precision or devise a survey method of very high accuracy. Trials have shown that small unit plots are not satisfactory and a study is being given to plot size and shape. A study was made of personal bias in three methods of random selection of grass plants for height measurement. Selection without mechanical help is strongly biased, but further analysis is required to compare the merits of the two methods in which mechanical aid was used. A psychological quirk of many observers to "round off" values with a distinct bias to certain units,



FINANCIAL  
PROJECT:

WORK  
PROJECT:

RESEARCH  
PROJECT:

PLANS  
F. Y.  
1938:

is revealed in this study. There is thus disclosed a heretofore unsuspected need for training in such elementary techniques as linear measurement.

The adequacy of mechanically improved point-analyses and decimeter-estimates, and other methods which give promise, to be further tested as in 1938 and against clipping yields as standards.

SCOPE:

Efficiency of several plot sizes and shapes to be determined with the object in view of getting the most information with the least cost.

STATUS:

An application to be made to survey work of the most reliable intensive method with the ultimate object of sampling entire pastures as well as certain selected areas.

A method of utilization measurement to be worked out, using numerous small hurdle plots and checking against actual yields the trustworthiness of estimates made with and without reference to the ungrazed vegetation.

RESULTS:

PLANS  
F. Y.  
1938:

Time and funds permitting, a comparison of intensive methods to be made on the range types at Vigilante. In addition to the techniques compared at Miles City, Pearse's area-list method and a method of linear transections give promise in the bunch-grass types.

ASSIGN-  
MENT:

ASSIGN-  
MENT:

Lincoln Ellison with temporary assistance.



**FINANCIAL  
PROJECT:**

Range Investigations.

**WORK  
PROJECT:**

Seasonal Use Investigations.

**RESEARCH  
PROJECT:**

Seasonal Use on Mountain Summer Ranges.

Working plan not prepared but a tentative experimental design has been worked out and submitted to Washington by letter of February 15, 1937.

**SCOPE:**

To determine the date and intensity at which short season ranges may be grazed in spring without undue sacrifice to welfare of the forage cover but so adjusted as to obtain all possible benefits of early use.

**STATUS:**

New F. Y. 1938. Boundaries of the Vigilante Experimental Range have been fenced and some improvements built. Detailed range survey completed last summer and data now being compiled. ERA funds can be used to complete individual pasture setup during 1937 as soon as project outline is approved.

**RESULTS:**

None to date.

**PLANS  
F. Y.  
1938:**

Start project records on 12 pastures and approximately 80 head of cattle in May, 1938.

**ASSIGN-  
MENT:**

Junior or Assistant Range Examiner to be selected. Improvement work in C. Y. 1937 to be supervised by E. H. Dobrinz who has carried the work there during the past two seasons.



**FINANCIAL PROJECT:** Forest Products Investigations.  
**WORK PROJECT:** Statistics of Production, Consumption, and Distribution of Forest Products.  
**RESEARCH PROJECT:** Statistics. (Includes Annual Lumber Census, Prices and Lumbering Costs.)  
**WORKING PLANS:** Census work covered by cooperative agreement with Census Bureau and Western Pine Association.  
**STATUS SHEETS**  
 Wholesale lumber selling values covered by cooperative agreement with Western Pine Association dated July 1, 1916, and subsequent annual renewals.  
**FOREST PRODUCTS**  
 No definite plans have ever been prepared covering other lumber and timber products, price statistics nor the logging and manufacturing cost project.  
**SCOPE:** The scope of this project is three-fold:  
 Activity 1. A canvass of all the sawmills and producers of miscellaneous timber products to obtain the production of lumber, lath, shingles and miscellaneous timber products.  
 Activity 2. Collection of lumber and timber products price statistics for northern Idaho, eastern Washington, and western Montana, in sufficient volume to indicate periodic trends in the selling price of lumber (wholesale and retail), stumpage, logs, cedar products, and ties.



**FINANCIAL  
PROJECT:**

Forest Products Investigations.

**WORK  
PROJECT:**

Statistics of Production, Consumption, and  
Distribution of Forest Products.

**RESEARCH  
PROJECT:**

Statistics. (Includes Annual Lumber Census,  
Prices and Lumbering Costs.)

**WORKING  
PLANS:**

Census work covered by cooperative agreement  
with Census Bureau.

Wholesale lumber selling values covered by  
cooperative agreement with Western Pine Association  
dated July 22, 1916, and subsequent annual  
renewals.

No definite plans have ever been prepared  
covering other lumber and timber products, price  
statistics nor the logging and manufacturing  
cost project.

**SCOPE:**

The scope of this project is three-fold:

Activity 1. A canvass of all the sawmills  
and producers of miscellaneous timber products  
to obtain the production of lumber, lath, shingles,  
and miscellaneous timber products.

Activity 2. Collection of lumber and timber  
products price statistics for northern Idaho,  
eastern Washington, and western Montana, in  
sufficient volume to indicate periodic trends  
in the selling price of lumber (wholesale and  
retail), stumpage, logs, cedar products, and ties.



RESULTS:

Activity 3. Collection of detailed logging and manufacturing costs from the larger lumber companies in northern Idaho, eastern Washington, and western Montana, by personal contact.

STATUS:

F.Y.  
1933:

ASSIGN-  
MENT:

Activity 1. This work is handled each year for the States of Idaho and Montana in cooperation with the Bureau of Census. On the average 600 concerns are canvassed, some of which require personal solicitation. It is planned to continue this cooperative project indefinitely.

Activity 2. Annual wholesale lumber prices are now available dating back to 1912. Retail prices on lumber are available dating back to 1920. Wholesale prices on logs, ties, and cedar products are also available back to 1920. Stumpage prices have been recorded annually since 1912 and are furnished currently to interested agencies.

Activity 3. Detailed average lumber production costs are now available back to 1916. Last year costs were obtained from 30 Inland Empire operators representing operations in all commercial forest types of Montana, Idaho, and northeastern Washington.



**RESULTS:** Collected and compiled statistics on all  
**PROJECT:** Forest Products Investigations.  
the activities outlined above last year as in  
**WORK**  
**PROJECT:** the past. Publication on "Stumpage Prices  
Since 1912" was revised and distributed as a  
**RESEARCH**  
**PROJECT:** Logging and Milling.  
mimeographed circular.  
**WORKING**  
**PLANS:** Instructions for the mill study. I. V.  
**F.Y.** Continuation of all activities in project.  
**1938:** Anderson, July 18, 1931.  
Study plan for a woods and mill study  
of ponderosa pine at the Greenough, Montana,  
**ASSIGN-** Whitney to Activity 1; Rapraeger to  
**MENT:** stumpage prices and Bouchard to balance of  
operation of the Anaconda Copper Mining  
Activity 2; Anderson and Neff (Regional Logging  
Company. I. V. Anderson, July, 1932.  
Engineer) to Activity 3.  
Study plan for a woods, sawmill, and  
factory study of western white pine from the  
band mill operation of the White Pine Lumber  
Company, Grange, Idaho. I. V. Anderson,  
B. E. Hubert, and Kenneth Davis. July, 1933.  
Study plan for a woods and mill study  
of ponderosa pine from the wellpinit operation  
of the Deer Park Lumber Company. I. V. Anderson,  
and H. E. Holman. March, 1935.  
**SCOPE:** This project provides information on the  
important phases of logging and milling. They are:  
1. Selective logging - which has three objectives:  
a. To determine (1) cost of growing stumpage  
suitable for sawlogs, ties, mill  
timber, etc., (2) production costs,  
transportation and their effect upon wood  
forestry production.



FINANCIAL PROJECT: Forest Products Investigations.  
WORK PROJECT: Production Costs and Utilization Investigations.  
RESEARCH PROJECT: Logging and Milling.

WORKING PLANS: Instructions for the mill study. I. V. Anderson. July 13, 1931.

Study plan for a woods and mill study of ponderosa pine at the Greenough, Montana, operation of the Anaconda Copper Mining Company. I. V. Anderson. July, 1932.

Study plan for a woods, sawmill, and factory study of western white pine from the band mill operation of the White Pine Lumber Company, Crofino, Idaho. I. V. Anderson, E. E. Hubert, and Kenneth Davis. July, 1935.

Study plan for a woods and mill study of ponderosa pine from the Wellpinit operation of the Deer Park Lumber Company. I. V. Anderson, and H. E. Holman. March, 1935.

SCOPE: This project provides information on two important phases of logging and milling. They are:

1. Selective logging - which has three objectives:
2. a. To determine (1) cost of growing stumpage suitable for sawlogs, ties, mining timber, etc., (2) production costs transportation and their effect upon good forestry practice.



STATUS: 1. Select and market values when the various  
taken tree species found in each commercial  
ponderosa forest type in the Region are utilized  
fir type. for lumber and other commodities.

Final results to show for an individual  
pine, holding, logging chance or sample plot,  
tree cutting limits (by tree d.b.h. and the  
west area) and utilization standards

Dough necessary to provide a reasonable  
outfit profit for the operator when practicing  
study varying degrees of silviculture.

b. To make available to lumbermen, foresters,  
and other interested agencies, information  
Study work compilation available  
obtained incidental to the main project,

a. Ponderosa pine type  
Heron Lumber such as overrun data, efficiency  
Harper Lumber Co.  
J. Neils Lumber comparisons of various types of logging  
A.C.M. ReLogging  
A.C.M. 1932 and milling equipment, etc.

b. Western white c. To make available to the same agencies,  
Region wide 1935  
mill seal data fundamentally useful in the  
Ohio Hatch Co.  
White Pine promotion of good forest practice on

c. Larch-Douglas private and public lands of the Inland  
Kinshella The Mills Complete Yes  
Empire.

2. Results of logging output studies, including

2. Logging output studies designed to measure  
principal phases of logging in the major  
the efficiency of new logging equipment, new  
commercial forest types, published in 1935  
and in 1936, data made available in practically  
logging methods, and various methods of log  
transportation and their effect upon good  
forestry practice.



STATUS: 1. Selective logging studies have been undertaken in the western white pine type, the ponderosa pine type, and the larch-Douglas fir type. Information is now available on economic tree and log grades for ponderosa pine, also on the minimum-sized profitable tree in (1) the ponderosa pine type, (2) the western white pine type, and (3) the larch-Douglas fir type for several methods of cutting.

Studies and their status are listed below by timber types.

<u>Study</u>	<u>Field work</u>	<u>Office compilation</u>	<u>Results made available</u>
<u>a. Ponderosa pine type</u>			
Heron Lumber Co.	Complete	Complete	Yes
Harper Lumber Co.	"	"	"
J. Neils Lumber Co.	"	"	"
A.C.M. ReLogging	"	"	"
A.C.M. 1932	"	"	"
<u>b. Western white pine type</u>			
Region wide 1925	"	"	"
mill scale	"	"	"
Ohio Match Co.	"	"	"
White Pine Lbr. Co.	"	2/3 complete	potentially 1/4
<u>c. Larch-Douglas fir type</u>			
Kinshella Tie Mills	"	Complete	Yes

2. Results of logging output studies, including principal phases of logging in the major commercial forest types, published in 1933 and in 1934, data made available on practically



every phase of current logging practice in the ponderosa pine type. This part of the project is of a continuous nature and minor studies needed to supplement major case studies in selective logging are made from time to time.

RESULTS: 1. Selective Logging - major case studies.

a. All field work and about two-thirds of the office compilation work are completed for the White Pine Lumber Company study. In June, 4600 logs from 880 trees were followed through the sawmill. In September, match plank sawed in June was followed through the match block factory at Orofino. Blocks representing different variables were manufactured into match splints at Chico, California, in January, completing field work for the study.

b. Further assistance was rendered Region Three of the Forest Service on the Southwest Lumber Mills study. Data were compiled showing yield of lumber by grades and sizes for the six economic tree grades



used in the study. Values were also computed by tree grades.

- c. Final report on Kinshella Tie Mills project was completed and results of study published in a trade journal.

2. Minor Case Studies.

- a. Transportation plan consisting of written report and 4 and 8-inch scale topographic road maps were completed for the three Experimental Forests now under administration. As construction work progresses additional work will be necessary to see that final road locations embody most recent developments in utilization road construction.
- b. A comprehensive report dealing with prevailing exploitation practices and problems in the Inland Empire and recommendations for the improvement of said practices were prepared and submitted to the Society of American Foresters.
- c. A study of horse skidding in white pine was made as a supplement to the White Pine Lumber Company study.



**PLANS** 1. Complete all phases of the white Pine Lumber  
**P.Y.** Forest Products Investigations.  
**1938:** Company study including compilation of final  
**WORK** Investigations of Wood Treatments, Coatings,  
**PROJECT:** scientific report and publication and dis-  
tribution of results.

**RESEARCH**  
**PROJECT:** 2. Obtain lumber yield data on white pine trees  
**WORKING** below 180 years of age and determine value of  
**PLANS:** same for match plank.

3. Inaugurate study in cooperation with Division  
of Silvics designed to apply accumulated  
results of white pine selective logging  
studies to an individual logging chance.  
4. Apply accumulated results of ponderosa pine  
selective logging studies to operation of  
Anaconda Copper Mining Company and determine  
optimum cutting methods for sustained forestry  
practice.

5. Determine applicability of Region One's  
new power saw to felling and log making in  
the Inland Empire.

**ASSIGN-**  
**MENT:** Anderson and Kapraeger.

**STATUS:** The project now includes about 10 installa-  
tions distributed widely throughout the Region.  
More than 20,000 feet timbers consisting of full-  
sized railway ties, telephone and electrification  
poles, pole stubs, fence posts and mining timbers  
are included. Data on a few of these installa-



**FINANCIAL  
PROJECT:**

tions are obtained from inspections made by all Forest Products Investigations.

**WORK  
PROJECT:**

Investigations of Wood Treatments, Coatings, Paints, Glues, and Laminated Construction.

**RESEARCH  
PROJECT:**

Wood Preservation.

**WORKING  
PLANS:**

C. M. Undated general plan entitled "Instructions For Recording Data Regarding Preparation, Treatment, Placement, And Inspection of Experimental Ties, Posts, and Other Timbers," issued by the Forest Products Laboratory several years ago.

**RESULTS:**

Outlines prepared by P. R. Hicks, H. N. Knowlton, S. V. Fullaway, Jr., George M. Hunt, and C. N. Whitney for individual installations or studies.

**SCOPE:**

To determine the durability of treated and untreated local woods in actual service and the efficiency of various preservatives, including results of treatments by different processes, and to disseminate such information. This work is done in cooperation with the Forest Products Laboratory.

**STATUS:**

The project now includes about 20 installations distributed widely throughout the Region. More than 20,000 test timbers consisting of full-sized railway ties, telephone and electrification poles, pole stubs, fence posts and mining timbers are included. Data on a few of these installa-



tions are obtained from inspections made by oil, Forest Supervisors. In addition to the detailed service records obtained for poles specifically designated as experimental treated timbers, the Montana Power Company and the C. M. St. P. and P. Railroad Company furnish stubbing and replacement records on approximately 33,000 treated and untreated power line and electrification poles.

RESULTS: Inspections of various experimental timbers covered seven of the nine installations scheduled for examination in 1936. Proposed inspections of the paste treated western larch poles in the Mt. Henry telephone line of the Lolo Forest, and split cottonwood posts treated with mixtures of coal tar and spent crank case oil at the J. H. Ray ranch near Missoula were postponed for one year. The results of a study initiated by the Montana Power Company in the fall of 1924, to test the effectiveness of various field treatments applied to the butts of poles originally set untreated in 1923 and 1924 were obtained in a report furnished by Mr. J. P. Medlin, General Foreman for the company. In this series of tests, 330 poles were treated by digging away soil and applying varying quantities of creosote,



PLANS  
F. Y.  
1938

sodium fluoride, asphalt paint, transformer oil, creosote may be expected to give an average of 20 to 25 years' service on the main line of these preservatives at the base, after which the soil was replaced. Eighteen poles were treated

by applying a concrete ring at the base, 247 poles were treated by boring holes at a steep angle in the butts, filling these holes with

the preservatives mentioned, and then plugging

the holes. Two hundred ninety nine poles were left untreated. In 1936, after 12 years' service the company discontinued this study,

their final conclusions being that pole life was not increased sufficiently by these field treatments to warrant their use in competition with standard tank treatments. It was found

that drilling of holes in the base of a pole,

for pouring in preservatives, reduces the life of the pole under that of untreated poles, even

though the holes are carefully plugged after the preservative has been poured in. Asphalt paint apparently increased rapidity of pole butt decay.

Service tests conducted over a 26-year period by the Northern Pacific Railway Company, in which Forest Products has participated for 11 years, have indicated that creosoted western

Region, especially those known to have done very



hemlock ties may be expected to give an average of 20 to 25 years' service on the main line of this railway system.

PLANS  
F. Y.  
1938:

Make inspections and prepare tables or

reports for each of the following installations:

- Project L-50 Northern Pacific test track ties, Thompson Falls, Montana.
- Project L-214 Northern Pacific test track ties, Missoula, Montana.
- Project L-214 Missoula Monture telephone line, arsenic-treated poles and stubs, Lolo Forest, Montana.
- Project L-214 Mt. Henry telephone line, arsenic treated western larch poles, Lolo Forest, Montana.
- Project L-214 Fences located at J. H. Ray ranch, near Missoula, Montana. Cottonwood posts treated with mixtures of creosote and spent crank case oil.
- Project L-214 Ammen Fence, creosoted lodgepole pine posts, Missoula, Montana.
- Project L-214 Squaw Creek Ranger Station fences, posts treated with tetrachlorophenol-petroleum mixture, Gallatin Forest, Montana.
- Project L-214 Bozeman-Flathead telephone line, arsenic-treated stubs, Gallatin Forest, Montana.
- Project L-214 Choteau-Ear Mountain telephone line, creosoted lodgepole pine stubs, Lewis and Clark Forest, Montana.

If time permits, visit several of the best equipped Forest Service treating plants in this Region, especially those known to have done very



FINANCIAL  
PROJECT:

WORK  
PROJECT:

RESEARCH  
PROJECT:

ASSIGN-  
MENT:

efficient work in the treatment of telephone poles. Obtain diagrams and photographs showing storage yard and plant set-up, cost information, study output records, etc.

Working plan for sawmill studies in the C. N. Whitney.

Inland Empire, M. Straker, October 31, 1923.

Working plan for wood waste survey in logging. I. V. Anderson, April 23, 1928.

SCOPE:

This project will furnish information from time to time pertaining to utilization in the sawmill and the woods, with special reference to the following:

a. Overrun data and efficiency comparisons of logging and milling equipment.

b. Waste investigations designed to inventory and eliminate wood waste in lumbering.

c. Depreciation studies designed to measure volume and value losses caused by agencies such as fire, fungus stain, insects, and physical injury during the process of manufacture.

d. A determination of the practical value of log grades versus tree grades for the principal timber producing species of the Region.



**FINANCIAL  
PROJECT:**

Forest Products Investigations. and sawmill

**WORK  
PROJECT:**

efficiency studies have been presented to the  
Production Costs and Utilization Investigations.  
lumber industry of the Inland Empire.

**RESEARCH  
PROJECT:**

Woods and Mill Utilization. logging has been

**WORKING  
PLANS:**

A working plan for sawmill studies in the  
Inland Empire. M. Bradner. October 31, 1923.

Working plan for wood waste survey in the  
logging. I. V. Anderson. April 25, 1928.

**SCOPE:**

This project will furnish information  
from time to time pertaining to utilization in  
the sawmill and the woods, with special reference  
to the following:

a. Overrun data and efficiency comparisons  
of logging and milling equipment.

b. Waste investigations designed to  
inventory and eliminate wood waste in lumbering.

c. Depreciation studies designed to measure  
volume and value losses caused by agencies such  
as fire, fungus stain, insects, and physical  
injury during the process of manufacture.

d. A determination of the practical value  
of log grades versus tree grades for the  
principal lumber producing species of the Region.

**RESULTS:**

**PLANS  
F.Y.  
1930:**

**ASSIGN-  
MENT:**

I. V. Anderson and M. F. Bradner.



STATUS: a. The results of overrun and sawmill  
PROJECT: efficiency studies have been presented to the  
lumber industry of the Inland Empire.

WORK  
PROJECT: b. Residual wood after logging has been  
RESEARCH  
PROJECT: inventoried in the western white pine, ponderosa  
pine, larch-Douglas fir, and lodgepole pine  
types. Breakage loss in felling timber in the  
western white pine, ponderosa pine, and larch-  
Douglas fir types has been studied and results  
prepared for circulation to loggers and lumbermen.

WORKING  
PLAN: c. The results of comprehensive studies of  
fire damage, depreciation in river-driven white  
pine logs and depreciation in white pine logs several  
transported over gravity chutes, have been  
published and distributed to the northwestern  
lumber industry.

RESULTS: a. Project inactive during past year.  
b. No work planned, but project will be carried  
on active list.

PLANS  
F.Y.  
1938: of this source of our present timber supply,  
I. V. Anderson and E. F. Rapraeger.

ASSIGN-  
MENT: a. Western Larch. Bulletin No. 223  
published 1933.  
b. White Fir. Bulletin No. 400 published  
February, 1934.  
c. Lodgepole Pine.

STATUS:



**FINANCIAL  
PROJECT:**

All available data preparatory to publication of a bulletin were assembled by 1933.  
Forest Products Investigations.

**WORK  
PROJECT:**

Production Costs and Utilization Investigations.

**RESEARCH  
PROJECT:**

Species Utilization for Western Larch, White Fir, and Lodgepole Pine.

**WORKING  
PLAN:**

General working plan, Project L-264, by Bryant D. Dain, Forest Products Laboratory,

**RESULTS:**

March 10, 1923.

**PLANS  
F.Y.  
1933:**

Species outlines by S. V. Fullaway, Jr., William Gibbons, and C. B. Green in 1923 and 1924.

**SCOPE:**

a. To prepare or assist in preparing bulletins to furnish detailed information on the properties and characteristics of the wood of several of the Region's little-used species (western larch, white fir and lodgepole), which will assist consumers in determining the suitability of the species for specific uses. Generally it is intended to promote the good utilization of such

**ASSIGN-  
MENT:**

species, thereby increasing the economic value of this source of our present timber supply.

**STATUS:**

a. Western Larch. Bulletin No. 285 published 1932.

b. White Fir. Bulletin No. 408 published February, 1934.

c. Lodgepole Pine.



All available data preparatory to publication of a bulletin were assembled by 1933. Then more urgent work in connection with the Depletion and Requirements phase of the Forest Survey and widespread insect losses in lodgepole pine stands of the Northern Rockies caused suspension of this project.

RESULTS: No work was done.

PLANS  
F.Y.  
1938:

STATE SHEETS  
The need for a bulletin on utilization of lodgepole pine has been greatly reduced because of current economic conditions in the lumber industry, which makes any expansion in the sale and utilization of this species in the near future seem unlikely. Therefore it is recommended that this project be discontinued because of (1) the present status of lodgepole pine utilization and (2) lack of funds and personnel.

ASSIGN-  
MENT:

None.



**FINANCIAL  
PROJECT:**

Forest Management Investigations.

**WORK  
PROJECT:**

Silvicultural Investigations.

**RESEARCH  
PROJECT:**

M-1. Western White Pine - Natural Regeneration.

**WORKING  
PLANS:**

There have been a number of working plans dating back to 1913 for specific studies under this general project. The most recent are:

1. **STATUS SHEETS** Study of Natural

Reproduction after Cutting and Forest Fires

by Robert Marshall, 1927. This plan was the general basis for extensive methods of cutting and regeneration studies, now largely completed.

**SILVICS**

2. Working plan for Instrumental study of the Important Physical Factors of site affecting Early Survival, by I. T. Haig, 1932. This study now completed.

3. Working plan for Study of Cut-over Areas, by I. T. Haig, 1933.

**SCOPE:**

Factors affecting natural regeneration, including germination, initial survival, early establishment, and methods of cutting.

**STATUS:**

Field work on this general project largely at a standstill. Work planned under the three working plans listed above is mostly completed.



FINANCIAL  
PROJECT:

Forest Management Investigations.

WORK  
PROJECT:

Silvicultural Investigations.

RESEARCH  
PROJECT:

M-1. Western White Pine - Natural Regeneration.

WORKING  
PLANS:

There have been a number of working plans dating back to 1913 for specific studies under this general project. The most recent are:

1. Working plan for Study of Natural Reproduction after Cutting and Forest Fires by Robert Marshall, 1927. This plan was the general basis for extensive methods of cutting and regeneration studies, now largely completed.

2. Working plan for Instrumental Study of the Important Physical Factors of Site Affecting Early Survival, by I. T. Haig, 1932. This study now completed.

3. Working plan for Study of Cut-over Areas, by I. T. Haig, 1928.

SCOPE:

Factors affecting natural regeneration, including germination, initial survival, early establishment, and methods of cutting.

STATUS:

Field work on this general project largely at a standstill. Work planned under the three working plans listed above is mostly completed. Deception Creek Experimental Forest completed and



Studies now in progress are: successfully burned.

Pre-1. Cone crop observations of western white pine and associated species. During 1935 and 1936 this study has been expanded somewhat to get better information on the effect of size, vigor, crown, and tree classes on cone production of western white pine. Seed trap observations are being made on a few selected plots to determine season and quantity of seed fall.

2. Methods of cutting. At Deception Creek several experimental and demonstration cuttings have been made and it is planned to continue these cuttings year by year on a small scale.

E. P. Davis, G. A. Wellner.

RESULTS:

1. Manuscript preparation. Comprehensive bulletin summarizing all important investigations bearing on natural regeneration partially prepared. Results of study of factors controlling initial survival in western white pine (working plan 2) published by I. T. Haig as Yale School of Forestry Bulletin No. 41. Report for publication on study of cut-over areas (working plan 3) nearly completed.

2. Field work. Cone crop examinations made as scheduled. Strip-shelterwood cutting in Deception Creek Experimental Forest completed and



FINANCIAL PROJECT: slash in clear-cut strips successfully burned. Forest management investigations.

WORK PROJECT: Pre-logging disposal project of hemlock and other low-value species on a south slope in Deception Creek accomplished. Cleanings of

RESEARCH PROJECT: 1. Complete manuscripts. of less than

PLANS F.Y. 1938: 2. Thoroughly review and evaluate results to date and prepare specific working plans if study is continued. The annual cone crop examinations as now conducted should be dropped and a new approach made. the development of reproduction

WORKING PLANS: 3. Substitute preliminary light measurement studies. in the western white pine type as

SCOPE: affected by residual overwood, composition of

ASSIGNMENT: K. P. Davis, C. A. Wellner. reproduction, and cultural measures. Long-term project.

STATUS: To date, 42 plots sampling a number of stand conditions have been established. Cleanings or cleanings have been made in several of these.

PLANS F.Y. 1938: Measurements are to be made to determine development changes. Several large scale cleaning projects have been accomplished both on the Deception Creek Experimental Forest and on National Forests.

RESULTS: Available information on best cultural methods to use in young stands assembled and issued



**FINANCIAL PROJECT:** is mimeographed form as part of "Stand Forest Management Investigations. Improvement measures for the western white pine

**WORK PROJECT:** Silvicultural Investigations. 1934. Principal

**RESEARCH PROJECT:** Mt-1. Western White Pine; Cleanings or Weedings in Reproduction Stands of Less Than Pole Size. Improvement measure applicable

**WORKING PLANS:** Working Plan for the Study of Seedling Development in the Western White Pine Type. Kenneth Davis, August 1, 1935.

**SCOPE:** To study the development of reproduction stands (less than pole size) of associated species in the western white pine type as affected by residual overwood, composition of reproduction, and cultural measures. Long-time project.

**STATUS:** To date, 42 plots sampling a number of stand conditions have been established. Weedings or cleanings have been made in several of these.

**PLANS F.Y. 1938:** Remeasurements are to be made to determine development changes. Several large scale cleaning projects have been accomplished both on the Deception Creek Experimental Forest and on National Forests.

**ASSIGNMENT:**

**RESULTS:** Available information on best cultural methods to use in young stands assembled and issued



FINANCIAL  
PROJECT:

WORK  
PROJECT:

RESEARCH  
PROJECT:

WORKING  
PLANS:

SCOPE:

STATUS:

ASSIGN-  
MENT:

RESULTS:

PLANS  
F.Y.  
1938:

ASSIGN-  
MENT:

in mimeographed form as part of "Stand Improvement Measures for the Western White Pine Type," issued in September, 1936. Principal conclusions: Cleanings offer the greatest promise of desirable results at minimum expense of any stand improvement measure applicable in immature stands in the western white pine type. Experience and observation indicate that the proportion and quality of white pine in the type can be most effectively and cheaply increased while the stand is very young.

Progress report summarizing results obtained from sample plots established in 1935 prepared.

Field work in 1936 consisted of completing the establishment of one series of development study plots begun late in 1935.

Make light intensity measurements on selected plots. Review working plan for adequacy.

Forestry Note No. 76.

K. P. Davis, C. A. Wellner.

Considerable cooperative work with the National Forests done by visiting various stand improvement projects, furnishing available information, and making suggestions as to the conduct of the work.



**FINANCIAL  
PROJECT:**

Available information on thinning  
Forest Management Investigations.  
assembled and released in September, 1936, as a

**WORK  
PROJECT:**

Silvicultural Investigations. Measures for the

**RESEARCH  
PROJECT:**

West Mt-1. Western white Pine; Thinnings or  
Other Cuttings in Immature Stands of Pole Size  
or Larger.

**WORKING  
PLANS:  
1938:**

No working plan for this project other than  
establishment reports for individual sample plots.

**SCOPE:**

Development of immature stands of pole size  
or larger as affected by cutting. Includes  
pruning.

**STATUS:**

Project consists of 39 permanent sample  
plots (including check plots), one of them a  
16-subplot latin square, in stands variously  
treated. Plots remeasured at 5-year intervals.

**ASSIGN-  
MENT:**

**RESULTS:**

Preliminary tests of pruning equipment and  
methods most suitable to western white pine  
stands conducted and results released as Applied  
Forestry Note No. 76.

Considerable cooperative work with the  
National Forests done by visiting various stand  
improvement projects, furnishing available  
information, and making suggestions as to the  
conduct of the work.



**FINANCIAL PROJECT:** Available information on thinning  
**WORK PROJECT:** Forest Management Investigations,  
assembled and released in September, 1936, as a  
part of "Stand Improvement Measures for the  
**RESEARCH PROJECT:** Western White Pine Type."  
ME-1. Western White Pine: Growth and Yield.  
**WORKING PLANS:** One new permanent plot established and one  
1. Working plan for installation of  
plot reestablished.  
permanent sample plots. J. A. Larson, 1922.  
**PLANS F.Y. 1938:** Prepare report on Priest River Branch  
1919-1914 plots. Prepare report on statistical  
analysis of the height and diameter measurements  
on Plot 37, the latin square plot. No plot  
remeasurements scheduled for 1937.  
Thoroughly review project and prepare  
working plan specifically stating policy,  
objectives, and procedure for continuance.  
increment phase, Haig, 1922.  
**ASSIGNMENT:** K. P. Davis.  
5. Working plan for study of application  
of normal yield tables, Haig, 1924.  
**SCOPE:** To improve existing normal yield tables  
and apply to partially stocked stands. Determination  
of mortality and developmental changes of uncut  
stands. Study of growth on residual trees left  
after logging and preparation of growth-after-  
cutting yield tables.  
**STATUS:** Total of 34 permanent and 54 semi-permanent  
plots. Prepare report on increment about logging



**FINANCIAL PROJECT:**

plots in uncut stands. Plots mostly established between 1922 and 1926. Remeasurement at 5- and

**WORK**

**PROJECT:**

Mensuration Investigations.

**RESEARCH PROJECT:**

Increment and mortality observations of the residual stand on 34 permanent plots in cut-over

**WORKING PLANS:**

1. Working plan for installation of permanent sample plots, J. A. Larsen, 1922. Continuing project.

2. Suggestions for the collection of sample plot data for yield tables in even-aged cut-over areas in white pine type. Field work stands. Anonymous, 1924.

3. Standardization of methods of preparing volume and yield tables, Washington Committee on Stem analysis study of volume growth in 18

Growth and Yield, 1926. years after cutting in Santa Creek seed tree area

4. Working plan for study of cut-over areas, made and compilation work completed. Report to be prepared for publication.

5. Working plan for study of application Remeasurement of 36 semi-permanent plots and compilation of data for all semi-permanent plots

**RESULTS:**

**SCOPE:**

To improve existing normal yield tables for the first 10-year period. Remeasurement of and apply to partially stocked stands. Determination of mortality and developmental changes of uncut following logging.

stands. Study of growth on residual trees left after logging and preparation of growth-after-cutting yield tables. (stocking studies).

**STATUS:**

Total of 34 permanent and 56 semi-permanent 1. Prepare report on increment after logging

PLANS  
F.Y.  
1933:

studies.



plots in uncut stands. Plots mostly established between 1922 and 1926. Remeasurement at 5- and 10-year intervals.

Increment and mortality observations of the residual stand on 24 permanent plots in cut-over and burned-over areas. Periodic remeasurements. Continuing project.

Increment study using temporary plots on cut-over areas in white pine type. Field work and basic compilation completed but report not yet prepared.

Stem analysis study of volume growth in 18 years after cutting in Sands Creek seed tree area made and compilation work completed. Report to be prepared for publication.

RESULTS: Remeasurement of 30 semi-permanent plots and compilation of data for all semi-permanent plots for the first 10-year period. Remeasurement of 14 permanent plots for increment and mortality following logging.

See Forest Survey Growth Phase for progress on study of application of normal yield tables (stocking studies).

PLANS  
F.Y.  
1938:

1. Prepare report on increment after logging studies.



# FINANCIAL

PROJECT:

2. Thoroughly review project and revise

## WORK

PROJECT:

working plans.

3. Remeasure plots scheduled for examination.

## RESEARCH

PROJECT:

4. Continue cooperation with the Forest

## WORKING

PLANS:

Survey in application study of normal yield tables to natural stands.

ponderosa pine at the Greenough, Montana, operation

## ASSIGN-

MENT:

K. P. Davis, S. E. Brown, by L. V. Anderson, et al.,

1932.

## SCOPE

AND

STATUS:

Increment and mortality of residual stand and reproduction following logging on three selectively cut ponderosa pine plots near Greenough, Montana, and one ponderosa pine plot in 1932. A cooperative project between Station divisions of Silviculture and Products, Region's division of Management, State and private agencies. Silviculture responsible for periodic measurements.

## RESULTS

OF PAST

YEAR:

Annual examination of 60 reproduction quadrats and mortality of reserved trees.

## PLANS

F. Y.

1933:

Make annual examination of reproduction quadrats. Thereafter examine at 3-year intervals.

## ASSIGN-

MENT:

C. A. Walker.



**FINANCIAL PROJECT:** Forest Management Investigations.  
**WORK PROJECT:** Silvicultural Investigations.  
**RESEARCH PROJECT:** M-2 Ponderosa Pine; Removal and Regeneration.  
**WORKING PLANS:** No working plan other than plot establishment. Study plan for a woods and mill study of reports.  
**SCOPE:** ponderosa pine at the Greenough, Montana, operation of the A. C. M. Company by I. V. Anderson, et al., 1932.  
**STATUS:** Seven thinned and two check-plots established in 1928 with CCC's on Mill Creek administrative site of Hale Forest in dense 80-year stand. Two thinned cut ponderosa pine plots near Greenough, Montana, and one check plot established in 1935 in 80-year logged in 1932. A cooperative project between Station divisions of Silviculture and Products, Region's division of Management, State and private agencies. Silviculture responsible for periodic measurements.  
**RESULTS OF PAST YEAR:** Annual examination of 50 reproduction quadrats and mortality of reserved trees.  
**PLANS F. Y. 1938:** Make annual examination of reproduction quadrats. Thereafter examine at 5-year intervals.  
**ASSIGNMENT:** C. A. Wellner.



FINANCIAL  
PROJECT: Forest Management Investigations.

WORK  
PROJECT: Silvicultural Investigations.

RESEARCH  
PROJECT: Mt-2 Ponderosa Pine; Thinning.

WORKING  
PLANS: No working plan other than plot establishment

reports.

SCOPE: Development of immature stands older than  
saplings as affected by thinnings.

STATUS: Seven thinned and two check-plots established  
in 1933 with COC's on Mill Creek administrative site  
of Lolo Forest in dense 50-year stand. Two thinned  
and one check plot established in 1935 in 30-year  
stand at Remount Station. Six thinning plots estab-  
lished in 1918 and 1921 by Custer National Forest and  
subsequently inherited by the Station. Remeasurements  
made at 5-year intervals.

RESULTS  
OF PAST  
YEAR: None.

PLANS  
F. Y.  
1938: No remeasurements to be made. Prepare report  
on Custer thinning plots and review their status.

1938: No new field work planned.

ASSIGN-  
MENT: C. A. Wellner.

Review project and prepare new working plan  
for its continuation.

ASSIGN-  
MENT: C. A. Wellner.



FINANCIAL

PROJECT: Forest Management Investigations.

WORK

PROJECT: Mensuration Investigations.

RESEARCH

PROJECT: Me-2 Ponderosa Pine; Growth and Yield.

WORKING

PLANS:

Working plan for yield study of even-aged stands of ponderosa pine. Walter Meyer, July, 1932.

SCOPE:

Study growth, and prepare normal yield tables. Work out application of these tables to natural stand conditions.

STATUS:

About 110 semi-permanent plots used in normal yield study to be remeasured periodically.

Six permanent yield plots on Lolo National Forest remeasured periodically.

Data on 186 normal yield plots measured by this Station have been turned over to the Pacific Northwest Station as part of inter-regional growth study of ponderosa pine.

RESULTS  
OF PAST  
YEAR:

None.

PLANS  
F. Y.  
1938:

Remeasure 27 semi-permanent plots. Visit remainder of semi-permanent plots to establish permanent corners and amplify descriptive notes.

Review project and prepare new working plan for its continuation.

ASSIGN-  
MENT:

C. A. Wellner.



FINANCIAL  
PROJECT:

Forest Management Investigations.

WORK  
PROJECT:

Mensuration Investigations.

RESEARCH  
PROJECT:

ME-3. Larch-fir Growth and Yield.

WORKING  
PLANS:

1. Working plan for residual growth study of larch-fir cut-over areas. R. H. Weidman, 1932.

2. Working plan for yield study of western larch and Douglas fir. L. J. Cummings, June, 1935.

SCOPE:

Study growth and prepare normal yield tables. Work out applications to natural stands of mixed

ASSIGN-  
MENT:

species. Study growth of residual stands and prepare yield tables for partially cut stands.

STATUS:

1. Increment 25-35 years after cutting measured on 86 temporary plots. Volumes, etc., computed and preliminary report made. Final report for publication to be prepared.

2. Five permanent normal yield plots measured at 5-year intervals. A total of 150 temporary yield plots measured by Forest Survey (Growth Phase). Of these temporary plots, 42 have been selected for remeasurement as semi-permanent yield plots. Yield data analyzed and tables prepared by Forest Survey. An application



## FINANCIAL

## PROJECT:

Forest Management Investigations.

## WORK

## PROJECT:

study of normal yield tables to natural stands  
has also been made by Survey. No report for  
publication has been prepared.

## RESEARCH

## PROJECT:

ME-4. Western Red Cedar: Growth and Yield.

## RESULTS:

See Forest Survey (Growth Phase). Data  
from larch-fir growth-after-logging study made  
by Silviculture analyzed, volumes computed, and  
preliminary report prepared.

## WORKING

## PLANS:

To study growth of cedar in virgin and  
partially cut stands in the various associations.

## SCOPE:

## PLANS

## F.Y.

## 1938:

Prepare final report for publication on  
growth-after-logging study.

especially for poles, and the almost complete  
lack of information on its growth indicates a need

## ASSIGN-

## MENT:

No additional field work planned.  
K. P. Davis, R. H. Weidman. Information on

cedar urgently needed for growth phase of the

Forest Survey.

## STATUS:

New project. Some information available  
from permanent yield and thinning plots in the  
white pine type many of which contain cedar.

## RESULTS:

None in planning and execution of study.

## PLANS

## F.Y.

## 1939:

Prepare working plan for study in partially  
cut stands. Conduct field study in summer of 1937.  
The Forest Survey plans on making cedar growth  
study in virgin stands (see Forest Survey Growth  
Phase).

## ASSIGN-

## MENT:

Silviculture - K. P. Davis

Forest Survey - L. J. Cummings.



**FINANCIAL**

**PROJECT:** Forest Management Investigations.

**WORK**

**PROJECT:** Mensuration Investigations.

**RESEARCH**

**PROJECT:** ME-4. Western Red Cedar; Growth and Yield.

**WORKING**

**PLANS:** Study of immature cedar pole increment in virgin stands, L. J. Cummings, May, 1935.

**SCOPE:**

To study growth of cedar in virgin and partially cut stands in the various associations in which cedar occurs. The high value of cedar, especially for poles, and the almost complete lack of information on its growth indicates a need for immediate investigation. Information on cedar urgently needed for growth phase of the Forest Survey.

**STATUS:**

New project. Some information available from permanent yield and thinning plots in the white pine type many of which contain cedar.

**RESULTS:**

2. None in planting and handling of stock.

**PLANS**

**F.Y.**

**1938:**

3. Prepare working plan for study in partially cut stands. Conduct field study in summer of 1937. The Forest Survey plans on making cedar growth study in virgin stands (see Forest Survey Growth Phase).

**ASSIGN-**

**MENT:**

Silviculture - K. P. Davis

Forest Survey - L. J. Cummings.

to meet present needs. In spring (1936) 42 sub-plots planted in 4 localities and in fall 4 sub-



**FINANCIAL  
PROJECT:**

Forest Management Investigations.

**WORK  
PROJECT:**

Forest Regeneration Investigations.

**RESEARCH  
PROJECT:**

Forestation: Factors of Low Survival in  
Field Planting.

**WORKING  
PLANS:**

Preliminary Study of Suitable Time and Methods  
for Field Planting. R. H. Weidman and W. H. Cushman,  
May 21, 1936.

Study of Root-Soil Moisture Relationship of  
Planted Trees. R. H. Weidman, July 13, 1936.

Working plans by Rogers, Brewster, and  
Wahlenberg prepared during the decade beginning 1914.

**SCOPE:**

Causes of low survival in forest plantations  
of Region One. Initial attack on problem made by  
investigating for ponderosa and western white pine:

1. Soil moisture and other soil factors.
2. Care in planting and handling of stock.
3. Advanced growth of planting stock.
4. Season of planting.
5. Grade of stock.
6. Root development by grades of stock.
7. Class of stock.

**STATUS:**

Refer to reports by Wahlenberg and others  
for earlier work done. Previous research inadequate  
to meet present needs. In spring (1936) 42 sub-  
plots planted in 4 localities and in fall 4 sub-



FINANCIAL  
PROJECT:

plots in one locality (total 8,868 trees) to  
test all of above objectives except Number 6.

WORK  
PROJECT:

In addition a latin square plot to test survival  
by grades and two installations to ascertain root  
penetration by grades and age classes.

RESEARCH  
PROJECT:

WORKING  
RESULTS:

Considerable percentage of trees died before  
soil moisture dropped to 20 percent, indicating  
losses not due to summer drought. Carefully  
planted trees averaged 12 percent better survival  
than crew planted trees. Stock with advanced  
leader growth showed 8-15 percent lower survival.  
Of 4 top-root ratio grades of stock, the poorest  
survived only one-quarter as well as the others.  
Root excavations made at 10-day intervals showed  
the poorer grades penetrated the least and had  
much fewer new rootlets, thus keeping less well  
in contact with lowering soil moisture during  
season. Transplant stock survived better than  
seedling stock.

SCOPE:

STATUS:

PLANS

F.Y.

1938:

RESULTS:

ASSIGN-  
MENT:

Region to continue empirical tests with Station  
as consultant. Station to continue study of grades  
of stock in relation to root penetration and soil  
moisture.  
to both rodents and drought. Abundant evidence of  
R. H. Weidman (in cooperation with Region One).



**FINANCIAL  
PROJECT:**

Forest Management Investigations.

**WORK  
PROJECT:**

Forest Regeneration Investigations.

**RESEARCH  
PROJECT:**

Forestation: Direct Seeding.

**WORKING  
PLANS:**

Study of Direct Seeding Possibilities in  
Region One. R. H. Weidman, May 28, 1936.  
Project Working Plan. E. C. Rogers,  
August 21, 1916.  
Supplementary Working Plan. E. C. Rogers  
and T. P. Maloy, August 1, 1917.  
Second Supplementary Working Plan. P. C. Kitchin.  
July 12, 1919.

**PLANS**

**SCOPE:**

To investigate methods of direct seeding on  
recent burns.

**STATUS:**

For results of early work on this project see  
reports by Wahlenberg. Additional work initiated  
in October, 1935, when a number of small seed spot  
and broadcast plots were installed on one-year-old  
Selway burn. Eight species sown on north and south  
slopes. No screen or other protection.

**RESULTS:**

Selway plots examined in September showed a  
negligible number of seedlings alive. Failure due  
to both rodents and drought. Abundant evidence of  
mouse and pocket gopher activity, whereas there was



FINANCIAL  
PROJECT:

little or none in 1935 at the time of sowing.

WORK

PROJECT:

Douglas fir was the only species to show any

RESEARCH  
PROJECT:

ability to get started. In October sowing

plots were installed on the following newly

burned slash area on the Kaniksu Forest: (1) 4 x 4

WORKING  
PLANS:

latin square testing 4 seed spot treatments with

*Pinus monticola*, alternate spots screened; (2) three

replications of sets of three plots at 400, 800,

SCOPE:

1,200 feet from green timber, each plot with 20

seed spots of *P. monticola*, *P. ponderosa*, *Picea*

*engelmanni*, and each fourth spot screened.

PLANS

F. Y.

1938:

Examine germination in Kaniksu plots at

proper intervals. Install a few additional seed

spot plots if new burns become available.

ASSIGN-

MENT:

desirable planting or sowing methods.  
R. H. Weldman ( in cooperation with Region).

STATUS:

Work initiated in October, 1935, 70-acre

brushfield area at Beal's Butte, St. Joe

National Forest, surrounded with fire line

preparatory to burning. On 4 acres of this

area and on 4 acres adjoining, parallel 8-foot

strips 16 feet apart were cleared of brush

with a bulldozer. At Priest River Experimental

Forest a 6-acre brushfield area was selected

and surrounded with fire line preparatory to

burning.



RESULTS:  
FINANCIAL  
PROJECT:

Cleared strips outside 75-acre area at  
Forest Management Investigations. ponderosa

WORK  
PROJECT:

pine in May. Survival 80 percent in October.  
Forest Regeneration Investigations.

RESEARCH  
PROJECT:

One white pine and one ponderosa pine strip  
Forestation: Brushfield Planting and  
sprayed with strychnine-chloroform-resinol  
Seeding. (In cooperation with Region One.)  
solution for protection against rabbit injury.

WORKING  
PLANS:

Study of Preparatory Treatment and  
In October 75-acre area at Beal's Butte and  
Planting Methods for Brushfields. R. H. Weidman,  
6-acre area at Priest River broadcast burned  
May 26, 1936.

SCOPE:

In the St. Joe Forest are 200,000 acres  
of privately logged and burned white pine land  
donated to the Forest Service. Much of it  
has a dense brush cover and little reproduction.

PLANS  
P.Y.  
1935:

Its loess soil is probably the most productive  
in Region One. The problem is to ascertain  
desirable planting or sowing methods.

ASSIGN-  
MENT:

STATUS:

Work initiated in October, 1935, 75-acre  
brushfield area at Beal's Butte, St. Joe  
National Forest, surrounded with fire line  
preparatory to burning. On 4 acres of this  
area and on 4 acres adjoining, parallel 8-foot  
strips 16 feet apart were cleared of brush  
with a bulldozer. At Priest River Experimental  
Forest a 6-acre brushfield area was selected  
and surrounded with fire line preparatory to  
burning.



**RESULTS:** Cleared strips outside 75-acre area at Beal's Butte planted to white and ponderosa pine in May. Survival 80 percent in October.

**FINANCIAL PROJECT:** One white pine and one ponderosa pine strip sprayed with strychnine-chloroform-resinol solution for protection against rabbit injury.

**WORK PROJECT:** In October 75-acre area at Beal's Butte and 6-acre area at Priest River broadcast burned to kill brush.

**RESEARCH PROJECT:** Plant entire Beal's Butte area in spring of 1937. Clear parallel strips in Priest River area with bulldozer and plant entire area in spring or fall of 1937.

**WORKING PLANS:** R. H. Weidman (in cooperation with Region and Forest).

**SCOPE:** Compilation and analysis of field records on height, diameter, survival, and foliage characteristics dealing with needle per fascicle, needle length, color, persistence, and internal structure. Microscopic structural study in cooperation with University of Montana. Striking differences obtained between many races showing hereditary influences upon growth, form, survival, and foliage characteristics. Report submitted for publication February, 1937.

**PLANS F.Y. 1938:**

**STATUS:**

**ASSIGNMENT:**



**FINANCIAL  
PROJECT:**

Forest Management Investigations.

**WORK**

**PROJECT:**

Forest Regeneration Investigations.

**RESEARCH  
PROJECT:**

Forestation: Geographic Races.

**WORKING  
PLANS:**

Western Yellow Pine Seed Studies. District  
1, Section (d), Source of Seed. D. R. Brewster,  
February 12, 1916.

**ASSIGN-  
SCOPE:**

Progeny plots of ponderosa pine from 21  
widely separated U. S. seed sources started  
in 1911 to compare adaptation and development  
of geographic races in new environment.

**STATUS:**

Plots examined and reported upon by Kempff  
in 1927. Thorough field examination and  
measurements in fall 1935.

**RESULTS:**

Compilation and analysis of field records  
on height, diameter, survival, and foliage  
characteristics dealing with needles per  
fascicle, needle length, color, persistence,  
and internal structure. Microscopic structural  
study in cooperation with University of Montana.  
Striking differences obtained between many  
races showing hereditary influences upon growth,  
form, survival, and foliage characteristics.  
Report submitted for publication February, 1937.



FINANCIAL

PROJECT:

Forest Management Investigations.

PLANS

F.Y.

1938:

Start phenological observations in

FINANCIAL

PROJECT:

WORKING

PLANS:

progeny plots to ascertain relation of  
inherited differences in beginning and ending  
of growth activities to differences in form  
and adaptation. Seed collected from 6 progenies  
in 1936 available for growing second-generation  
stock.

ASSIGN-

MENT:

R. H. Weidman

SCOPE:

Arboretum of 800 acres at Priest River  
Branch started in 1932 to test in 1/4 to 1-acre  
blocks exotics and non-native species which  
climatically have a reasonable chance of surviving.

STATUS:

Planting done gradually year by year with  
40 species now started. Heavy losses from  
severe droughts which have prevailed since  
beginning. Full places replanted. Area mapped  
and corner posts of blocks set. Annual  
examinations made to date.

RESULTS:

No new blocks started but full places  
planted from stock retained in small hold-over  
nursery on ground. Small stakes set beside each



FINANCIAL

PROJECT:

Forest Management Investigations.

WORK

PROJECT:

Botanical Investigations.

RESEARCH

PROJECT:

Arboretum.

WORKING

PLANS:

No formal working plan. Map prepared in 1931 showing subdivision of the area with allocation of genera and species according to site requirements. Memoranda on instructions for current installations issued from year to year since 1932. Preliminary statement on purpose, area, and future plans prepared February 6, 1935.

SCOPE:

Arboretum of 200 acres at Priest River Branch started in 1932 to test in 1/4 to 1-acre blocks exotics and non-native species which climatically have a reasonable chance of surviving.

STATUS:

Planting done gradually year by year with 40 species now started. Heavy losses from severe droughts which have prevailed since beginning. Fail places replanted. Area mapped and corner posts of blocks set. Annual examinations made to date.

RESULTS:

No new blocks started but fail places planted from stock retained in small hold-over nursery on ground. Small stakes set beside each



FINANCIAL PROJECT:	tree in arboretum. Annual examination made.
WORK PROJECT:	Small trial lots of stock of 15 exotics started in Savenac Nursery. Most interesting Botanical Investigations.
RESEARCH PROJECT:	of these are 5-needed Pinus excelsa, P. koraiensis, P. cembra sibirica, believed to be blister rust resistant. Pinus peuce is already established in arboretum.
WORKING PLANS:	Outline for Conducting Phenological Observations in Montana and Northern Idaho. Plant 10 new blocks and plant fail places R. H. Weidman, April 24, 1938.
PLANS F.Y. 1938:	if funds are available for purchase of stock. Thirteen phenological stations located
SCOPE:	Prepare working plan. in 4 major types established in 1938 report
ASSIGNMENT:	annually R. H. Weidman. vegetative events. All observers are Forest Officers except one in Park Service.
STATUS:	Records for first 5 years compiled in 1938 for principal species. Field data posted on cumulative card records annually.
RESULTS:	Annual observations made.
PLANS F.Y. 1938:	Continuous annual observations.
ASSIGNMENT:	R. H. Weidman.



FINANCIAL  
PROJECT: Forest Management Investigations.

WORK  
PROJECT: Botanical Investigations.

RESEARCH  
PROJECT: Phenology.

WORKING  
PLANS: Outline for Conducting Phenological  
Observations in Montana and Northern Idaho.  
R. H. Weidman, April 24, 1928.

SCOPE: Thirteen phenological stations located  
in 4 major types established in 1928 report  
annually seasonal vegetative events. All  
observers are Forest Officers except one in  
Park Service.

STATUS: Records for first 5 years compiled in  
1933 for principal species. Field data posted  
on cumulative card records annually.

RESULTS: Annual observations made.

PLANS  
F.Y.  
1938: Continue annual observations.

ASSIGN-  
MENT: R. H. Weidman.



**FINANCIAL  
PROJECT:**

Survey of Forest Resources, Present and  
Future Requirements.

**RESEARCH  
PROJECT:**

Forest Survey. Covering the Northern Rocky  
Mountain Region of the Forest Service.

**SCOPE:**

The National Forest Survey is an economic study of the timber supply situation from both the national and the regional viewpoints. STATUS SHEETS of present supply with relation to local industry, transportation, and finance, and an attempt to forecast future supply and depletion from an analysis of depletion and growth trends, all in the light of domestic requirements, present and prospective, for forest products. When completed, the following results will be available.

1. Inventory Phase: The area of each type of forest cover and the estimated stand by species. Regrowth conditions on cut-over and burned lands will be determined.

2. Depletion Phase: Rate of depletion by cutting, fire, insects, disease, floods, and any other factors.

3. Growth Phase: Growth rate in old stands and on restocking areas and probable future yields.



**FINANCIAL  
PROJECT:**

Survey of Forest Resources, Present and Future Requirements.

**RESEARCH  
PROJECT:**

Forest Survey. Covering the Northern Rocky Mountain Region of the Forest Service.

**SCOPE:**

The National Forest Survey is an economic study of the timber supply situation from both the national and the regional viewpoints. It is a study of present supply with relation to local industry, transportation, and finance, and an attempt to forecast future supply and possibilities from an analysis of depletion and growth trends, all in the light of domestic requirements, present and prospective, for forest products. When completed, the following results will be available.

**ASSIGN-  
MENT:**

1. Inventory Phase: The area of each type of forest cover and the estimated stand by species. Regrowth conditions on cut-over and burned lands will be determined.

2. Depletion Phase: Rate of depletion by cutting, fire, insects, disease, floods, and any other factors.

3. Growth Phase: Growth rate in old stands and on restocking areas and probable future yields.



FINANCIAL  
PROJECT:

RESEARCH  
PROJECT:  
STATUS:

4. Requirements Phase: Present national and local requirements in forest products and probable trends.

The Forest Survey organization of this Station plans as the first unit to cover the "Inland Empire Region" of the Pacific Northwest. The project will eventually cover all of Region One of the Forest Service. In order to facilitate the preparation of status sheets, the Forest Survey project has been broken down into the four phases, Inventory, Growth, Inland Depletion, and Requirements, and a status sheet prepared for each.

ASSIGN-  
MENT:

M. Bradner, Regional Director.

WORKING  
PLANS:

Instructions for the Inventory Phase of the Forest Survey of the Inland Empire Region for lands other than National Forest (up to the point of checking and computing estimates and report preparation) - by M. Bradner and G.M. DeJarnette - Revised April, 1933.

Instructions for Check Cracking by M. Bradner and G.M. DeJarnette.

Instructions for the Inventory Phase of the Forest Survey in the Inland Empire Region on National Forests - DeJarnette and Howland.



**FINANCIAL  
PROJECT:**

Survey of Forest Resources, Present and Future Requirements.

**RESEARCH  
PROJECT:**

Forest Survey - Inventory Phase.

Unit 1. Covering the Inland Empire Region of the Pacific Northwest. The Inland Empire is defined as Montana, west of the Continental Divide; Idaho, north of the Salmon River; and the forested counties in northeastern Washington tributary to Spokane. Three counties, Spokane, Pend Oreille, and Stevens, have been designated as that part of the Inland Empire in northeastern Washington.

Unit 2. Covering Montana east of the Continental Divide, and Harding county, South Dakota.

**WORKING  
PLANS:**

Instructions for the Inventory Phase of the Forest Survey of the Inland Empire Region for lands other than National Forest (up to the point of checking and computing estimates and report preparation) - by M. Bradner and G.M. DeJarnette - Revised April, 1935.

Instructions for Check Cruising - by M. Bradner and G.M. DeJarnette.

Instructions for the Inventory Phase of the Forest Survey in the Inland Empire Region on National Forests - DeJarnette and Rowland.



Instructions for the office work of the Inventory Phase of the Forest Survey of the Inland Empire Region (up to the point of Volume Compilation and Report Preparation) Bradner and DeJarnette - Revised May, 1935.

Directions for compiling Timber Volumes in Immature Stands and Scattered Volume in Non-reproducing and Non Forest Types - by S.B. Hutchison.

Directions for Compiling Volumes in Merchantable Timber Stands by Counties - by P. Pratt - December, 1936.

Amended Instructions for Compiling the Merchantable Timber Volumes - by Bradner and Pratt - December, 1936.

Instructions for Converting NRM Types to PNW Types in Three Northeastern Washington Counties - by G.M. DeJarnette - January, 1935.

SCOPE:

There are approximately 37 million acres of forest land within the Northern Rocky Mountain Region. Of this, 25½ million acres are within the Inland Empire Region, the first unit to be worked. The remaining 11 plus million acres of forest land are in eastern Montana and Harding county, South Dakota (Unit 2). Approximately 60 percent of the grand total of forest land in the Region, or some 22 million



Table C.- STATUS OF INVENTORY PHASE, FOREST SURVEY

Units to be Credited	Area in Sq. Acres	Percent of Job Completed	
		Based on Total Acreage	Based on Number of County Reports
Northeastern Subregion	3,489	100	100
North Idaho	3,484	100	100
Western Montana	1,807	100	100
Island Empire (Unit 1)	51,051	100	100
Eastern Montana (Unit 2)	79,433	100	100
Northern Rocky Mt. Region	111,204	100	100
(1) Based on Acreage Mapped in Field			
(2) Based on Number of County Reports			

acres, is in the National Forests. Inventories of varying degrees of intensiveness have been made of the forest resources within the National Forests. All of the Forests, however, need some checking and additional information to bring them to Survey standards and several require practically a complete job of type mapping in place. Sixteen million nine hundred and ten thousand acres of forest land have been mapped in place in the field and two-inch-to-the-mile township maps in color have been prepared for all acreage mapped.

STATUS: The following table gives the status of the work as of March 1, 1937.



Table 8.- STATUS OF INVENTORY PHASE, FOREST SURVEY

Units to be Covered	Area in M. Acres		Percent Job Completed Based on Total Acreage of Forest Land					Percent of Job Completed		
	Gross	Forest Land	Collection of Data	Field Mapping	Adjustment Cruising	Office Compilation	(1)		(2)	
							2" to mile plats	1" to mile units		
Northeastern Washington	3630	2861	100	100	100	100	100	100	67	
North Idaho	12424	10603	100	100	100	70	100	85	20	
Western Montana	15807	12195	89	28		20	100	50		
Inland Empire (Unit 1)	31861	25659	95	66	53	46	100	81	20	
Eastern Montana (Unit 2)	79433	11219	40							
Northern Rocky Mt. Region	111294	36878	78	46	37	32	100	81	8	

(1) Based on Acreage Mapped in Field to Date

(2) Based on Number of County Reports Required



RESULTS  
OF PAST  
YEAR:

An allotment of emergency funds somewhat smaller than in 1935 allowed the work to progress but on a smaller scale than during the previous season. As planned, a bulk of the funds were used for adjustment cruising. Only three men were available for mapping-in-place during the field season. These men mapped approximately 350,000 acres, of which 365,000 acres were in North Idaho and 185,000 acres were in western Montana. Field mapping is now completed in all of North Idaho and northeastern Washington.

Five temporary adjustment cruisers under the supervision of Associate Timber Expert, Percy Pratt, adjusted the collected State and private estimates for all of North Idaho and northeastern Washington. This crew made a 10 percent cruise of some 51,000 sample acres and estimated over 960 million feet. Excellent correction factors have now been worked out from these cruises for all of the private and State estimates previously collected for these two units.

Two-inch-to-the-mile township type plats in color have been prepared for all of the acreage mapped to date in the field. These maps

show the field data collected to date. Since November,



PLANS  
F.Y.  
1938:

contain all of the inventory data collected by the field mapping crews. Four E.R.A. relief rollers and one C.C.C. boy worked on map tracing and map coloring during the past year. Excellent progress was made on the 1-inch-to-the-mile unit type maps by the two emergency draftsmen assigned to this job. Unit maps have now been prepared for 80 percent of all the acreage mapped in the field to date. These unit maps are 30"x48" compilations which contain an average of 40 townships. They form a complete and usable cover map of the forest land area.

It will be noted from the above discussion that field work on the inventory phase of the Forest Survey is now complete for North Idaho and northeastern Washington.

During the past year an office force of six E.R.A. relief rollers and one C.C.C. enrollee under the supervision of an E.C.W. technician have been working on the office compilation of field data. During the past winter this crew has been increased by the addition of six field men all of whom are E.C.W. technicians. By March 1, 1937, this office force will have compiled the acreage and volume data for 70% of all the field data collected to date. Since November,



1936, one man has been assigned to County Report writing and four such reports are finished (March 1, 1937).

PLANS  
F.Y.  
1938:

With the recommended increase of \$10,000 to the regular Forest Survey funds for F.Y. 1938, it will be possible to provide in addition to the present regular overhead of three men, a man to take charge of adjustment cruising, a Junior Forester to head up the County Report writing, three field assistants for a 3-4 months' field season, and the Division's share of the Station's overhead expense. If no emergency funds are allotted further field work on the inventory phase of the Survey will be out of the question and the small surplus of funds in the regular allotment will be used to compile, analyze and write up the results from the data already collected. If, however, emergency funds (including E.R.A., C.C.C., as well as E.C.W. research) equal in amount to those provided the Survey project during 1936 are made available during the coming year it will be possible to do the following jobs:

1. Map in place in the field in western Montana approximately 2,880,000 acres of forest land.
2. Adjust the collected State and private



FINANCIAL  
PROJECT:

RESEARCH  
PROJECT:

WORKING  
PLANS:

Survey of Forest Resources, Present and Future  
cruises in all of western Montana and the most  
urgent adjustments needed within the National  
Forests. This means making a 10 percent cruise  
of some 57,600 sample acres.

3. Prepare two-inch-to-the-mile township  
type maps in color for all acreage mapped during  
the field season. Complete the one-inch-to-the-  
mile unit type maps for all acreage mapped up  
to the end of the 1937 field season.

4. Finish the compilation of acreage  
and volume data for the North Idaho and north-  
eastern Washington units and prepare the remain-  
ing nine County Reports.

Emergency funds for the entire Survey  
project allotted during 1936 were as follows:

E.C.W. research - \$29,000.00 for 9 months' period

E.R.A. relief rollers - average crew of 8

C.C.C. - enrollees - average crew of 2

P. Kemp, P. Pratt, S.B. Hutchison, and M. Bradner.

SCOPE:

ASSIGN-  
MENT:

1. Annual growth  
2. Periodic annual growth  
3. Potential annual growth and  
4. Reliable mean annual growth, in  
forms of both cubic feet and board feet. Estimates  
will be made for the periods 1933 - 1945, 1945 -  
1955, and 1955 - 2000. Forest rates of de-



**FINANCIAL  
PROJECT:**

Survey of Forest Resources, Present and Future Requirements.

**RESEARCH  
PROJECT:**

Forest Survey - Growth Phase. was turned to the growth covering the Northern Rocky Mountain Region of the United States Forest Service.

**WORKING  
PLANS:**

All written by L.J. Cummings. data was made during the 1. Revision of office plan for pre-dicting growth for the Forests of the Northern Rocky Mountain Region. for the growth phase studies

2. A study of immature cedar pole and increment in virgin stands.

3. A study of growth characteristics of virgin, mature ponderosa pine. data was made during

4. Stocking correlation studies. on the

5. Yield study of western larch-Douglas fir. winter and spring of 1935 and 1936.

**SCOPE:**

To determine the growth rates in old forest stands and on restocking areas and the probable future yield. Growth estimates for this purpose will cover,

1. current annual growth ponderosa pine
2. periodic annual growth
3. potential annual growth; and
4. realizable mean annual growth, in terms of both cubic feet and board feet. Estimates will be made for the periods 1935 - 1945, 1945 - 1955, and 1935 - 2000. Present rates of de-

pine - Meyer



pletion are to be assumed for the periods in the future.

STATUS:

First active attention was turned to the growth phase of the Forest Survey in January, 1935. During that winter and spring a general survey of all available growth data was made and that suitable for use in predicting growth on the Forest Survey was picked out. A general work plan was drawn up for the growth phase including detailed working plans for several field projects.

The first field project was the larch-Douglas fir normal yield table which was made during the 1935 field season. Office work on the study was done in Washington, D. C. during the winter and spring of 1935 and 1936.

Basic growth tables available for Forest Survey use at present are:

1. Normal white pine yield tables - Haig
2. Interregional normal ponderosa pine yield table - Meyer
3. Normal larch-Douglas fir yield table - Cummings.
4. Normal lodgepole pine yield tables - Whitney
5. Yield of selectively cut ponderosa pine - Meyer



6. Board foot yield of selectively out larch-Douglas fir - NRM Division of Silviculture.

7. Normal yield table application studies in the western white pine type of North Idaho - Cummings.

8. Normal yield table application studies in the ponderosa pine type of northeastern Washington - Cummings.

9. Normal yield table application studies in the larch-Douglas fir type of North Idaho and northeastern Washington - Cummings.

The following additional growth studies must be done before growth rates and yield can be figured for the entire Northern Rocky Mountain Region.

1. Cedar pole increment study both in uncut and cut-over stands.

2. Application study of the inter-regional normal ponderosa pine yield tables to Forest Survey typed ponderosa pine areas of north-central Idaho.

3. Interregional normal ponderosa pine yield table for north-central Idaho.

4. A study of growth characteristics of virgin mature ponderosa pine in north-central Idaho.

5. Normal lodgepole pine yield tables



for Montana.

6. Increment study of selectively cut western white pine. This study is being done by the Division of Silviculture.

7. Application study of the normal larch-Douglas fir yield tables to Forest Survey typed larch-Douglas fir areas in Montana.

8. Construction of cubic foot increment tables for selectively cut larch-Douglas fir. This study is being done by the Division of Silviculture.

9. Determination of growth rates of immature Douglas fir in Montana.

10. Determination of growth rates of immature Engelmann spruce in Montana.

11. Increment study of selectively cut Engelmann spruce stands in Montana.

12. Application study of lodgepole pine yield tables to Forest Survey typed lodgepole pine areas of Montana.

13. Increment study of selectively cut lodgepole pine stands in Montana.

RESULTS OF  
PAST YEAR:

Due to the limited amount of Survey funds available, field work was possible on only two of the many studies needed. Normal yield table application studies in the white pine type of Idaho and the ponderosa pine type of northeastern



Washington were selected as most important.  
During the 1936 field season Cummings and two  
field assistants completed the two application  
studies. The office work of compilation was  
completed in January, 1937, and the process of  
computing current yields for Spokane county is  
underway.

A cubic foot volume table for western  
larch in alinement chart form was completed in  
December. The basic data were collected in  
conjunction with the larch-Douglas fir yield  
study and are applicable over the entire range  
of the larch type. Compilation was done in  
Washington, D. C. last spring under the new  
statistical technic outline by F.X. Schumacher  
of the Division of Forest Measurements.

Regular funds are only sufficient to pay  
the salary and expenses of L.J. Cummings on the  
Growth Phase of the Survey. Unless emergency  
funds are allotted, work on the project during  
1937 will be confined to collection of data or  
analysis on the part of Cummings alone. If,  
however, emergency funds equal in amount to those  
provided the Survey project during 1936, are  
made available during 1937, the following work  
will be completed:

1. Cedar pole increment study in un-



**FINANCIAL  
PROJECT:**

Survey of Forest Resources, Present and Future  
out stands. Data on out-overs to be secured by  
Division of Silvics.

**RESEARCH  
PROJECT:**

2. Complete the process of computing  
current yields for the northeastern Washington  
unit.

**ASSIGN-  
MENT:**

L.J. Cummings, R. Varney, M. Bradner.

**WORKING  
PLANS:**

Preliminary Report of Survey to determine  
forest losses in the forests of Region One - by  
Eric Anderson. - - - - -  
Plan for Field Work for the Fire De-  
pletion Study - by E.R. Anderson. - - - - -  
Plan of work for Cutting Depletion Study -  
by Anderson and Whitely.

**SCOPE:**

To determine the average annual rate of  
depletion by cutting, fire, insects, disease, or  
other major factors.

**STATUS:**

The cutting depletion phase of the project  
has been completed for the entire Northwest Rocky  
Mountain Region and a report issued. The report  
gives the average annual rate of depletion by  
cutting for all forest products by species group-  
ings for each county. The cutting depletion  
is estimated into that from volume of cut-  
ting and that from volume of logging waste.



FINANCIAL  
PROJECT:

Survey of Forest Resources, Present and Future  
Requirements. Species and Quantities for South

RESEARCH  
PROJECT:

Forest Survey - Depletion Phase Report.

Covering the Northern Rocky Mountain

Region of the United States Forest Service. This  
Region includes Stevens, Spokane, and Pend Oreille  
counties in Washington, Idaho north of the Salmon  
River, Montana, and Harding county, South Dakota.

WORKING  
PLANS:

Initial Preliminary Report of Survey to Determine  
Insect Losses in the Forests of Region One - by

Eric Anderson. Operations in Region One and the

General Plan for Field Work for the Fire De-

pletion Study - by S.B. Hutchison. years on the

General Plan of Work for Cutting Depletion Study -

by Hutchison and Whitney. Time and effort (time)

SCOPE:

To determine the average annual rate of  
depletion by cutting, fire, insects, disease, or  
other major factors.

STATUS:

The cutting depletion phase of the project  
has been completed for the entire Northern Rocky  
Mountain Region and a report issued. The report  
gives the average annual rate of depletion by  
cutting for all forest products by species separ-  
ately for each county. The cutting depletion  
is further divided into that from stands of saw-  
log size and that from stands under sawlog size.  
of insect losses by species and units is necessary



A table showing the average annual sawlog depletion by species and counties for South Idaho is also included in the Report.

Field work on the fire depletion phase of this project has been done on a small scale in 1935 and 1936. The field work in the North Idaho unit is about 50 percent complete. No field work has been done by the Survey Organization in northeastern Washington or Montana. The Division of Fire Research at the Station, the Division of Operation in Region One and the several Forest Fire Associations within the Region, have kept records for many years on the acreage and volume burned over by fire. These data together with the "before and after (fire) examination" in the field by the Survey organization will form the basis for figuring fire depletion.

The Region One Division of Timber Management, in cooperation with the Forest Insect Field Station at Coeur d'Alene, has gathered together general information on epidemic insect losses. These data have never been compiled and analyzed to furnish accurate figures on the average annual rate of depletion that could be applied to the Forest Survey data. A field survey of insect losses by species and units is necessary

RESULTS  
OF PAST  
YEAR:



to supplement the data already gathered. In 1935 a field survey crew of 2 men obtained the insect losses in about two thirds of the North Idaho unit. Due to insufficient funds no further work was possible.

The White Pine Blister Rust Control Office at Spokane, has collected during the past several years reliable information on loss from this particular tree disease. Arrangements are being made for the Office to furnish the Survey with detailed white pine blister rust losses by size and age classes. Though no definite check has been made on the epidemic loss from other tree diseases, these are considered to be negligible.

RESULTS  
OF PAST  
YEAR:

The mass of data that had been previously collected for the cutting depletion phase of this project was compiled and analyzed during the spring of 1936 by S.B. Hutchison and C.N. Whitney. The results of this study were finally issued in report form in October 1936. The report entitled, "Cutting Depletion in the Northern Rocky Mountain Region" gives in detail the average annual rates of depletion for all forest products by species separately for each county. Products cut from dead timber are kept separate from those cut from green timber and



No work was done in Bonner, Boundary, Benewah, or Latah counties, Idaho. The green timber depletion figures are further separated into material cut from trees of saw-log size and material cut from trees of less than sawtimber size.

Though the type mappers in 1935 made detailed examination of ten selected fires, no concentrated action was taken prior to 1936 on the fire depletion phase of the project. During the winter and spring of 1936 one man collected the office data on all of the class "C" fires which had occurred in North Idaho during the five-year period 1931, to 1935, inclusive. These fires were segregated by types and all the information that could be obtained on the area prior to the burn was obtained. During July, August, and September, 1936, Hutchison and one man made a detailed examination of 133 selected fires in North Idaho. Detailed maps were obtained on the type (species, sizes, volumes, etc.) before and after the fire. This information when compiled and analyzed should give good average figures by types as to the damage that actually occurs. Field work on this phase of the project was completed in Bonner, Boundary, Benewah and Kootenai counties in Idaho. Field examination for Shoshone, Clearwater, and Latah counties, Idaho, is well along but not completed.



No work was done in Nezperce, Lewis, or Idaho counties, Idaho.

Due to limited Survey funds no field work was possible during 1936 on any other phases of the depletion project.

Regular Survey funds are so limited that unless emergency funds are made available no field work can be done on the Depletion phase of the Survey in 1937. If there is an increase in regular funds and the same amount of emergency funds that were allotted in 1936 are made available for 1937, a field crew of three field assistants will be assigned to the fire depletion phase of the project for a 3 or 4 months' period during the summer. This crew should, in the time allotted, finish the field examination of fires in the remainder of the North Idaho unit and in the three northeastern Washington counties.

The Spokane White Pine Blister Rust Control Office should with some assistance from this Office be able to furnish figures on the epidemic loss, by size and age classes, for the several units in white pine from blister rust.

No further work on insect losses by members of the Survey organization is contemplated or possible.

\_\_\_\_\_, M. Bradner.

ASSIGN-  
MENT:



**FINANCIAL  
PROJECT:**

Survey of Forest Resources. Present and Future Requirements.

**RESEARCH  
PROJECT:**

Forest Survey - Requirements

**WORKING  
PLANS:**

Working Plan - Study of Requirements by Hallauer, 1932.

Revised Working Plan - Timber Requirements for Urban Construction. By Hallauer, 1932.

Plan of Work for Survey of Requirements in Northern Rocky Mountain Region. By Whitney, May, 1933.

Procedure for Making Fuelwood and Fence Post Requirements Surveys. S.B. Hutchison.

**SCOPE:**

To determine the current need for forest products based on present consumption. To determine the trends in the uses of forest products and the underlying causes for such trends. To determine the major opportunities for expansion in outlets for products of our forest lands.

**STATUS:**

Collection of data on volume and type of construction in cities selected as sample plots has been completed. Seven of the principal cities of the region, including Missoula, Butte, Bozeman, Livingston, and Great Falls, Montana; Lewiston, Idaho, and Spokane, Washington, have

been worked up and sent to Mr. Hallauer.



been covered. In five of these cities detailed card records for each new building or repair permit issued in 1929 were made. At Spokane and Butte, data needed to supplement published records were obtained. Building permit records collected in five cities have been sorted and tabulated by classes of buildings, types of construction, etc., preparatory to the application of conversion factors. Thirty-three bills of material for use in determining the relation between cubic volume of different classes of buildings and the lumber required in their construction have been obtained. The bills of material for urban dwelling construction have been tabulated under headings showing framing lumber, siding, finish, doors, windows, and other millwork separately. Conversion factors showing the relation between cubic volume and lumber footage have been computed but before applying them to the city building records, the board foot per cubic foot factors for different types of construction should be rechecked and made more reliable through the inclusion of data from a few more material lists which can be obtained from contractors at Missoula. Some conversion factors for frames, sash, and doors, have been worked up and sent to Mr. Hallauer.



In several of the cities sampled, summaries showing total volume of construction and number of living units provided annually, 1921-1930, inclusive; vacancy records and timber requirements of city governments were collected. Records showing the consumption of lumber and other forest products used by four county governments in construction by their own forces have been obtained. Data on total mileage of lines and annual timber requirements of nearly all of the principal telephone and electric utilities in Montana and northern Idaho have been collected. Statistics of lumber and miscellaneous timber products consumed by the copper mining industry in Montana have been compiled, and brought up to date. Conversion factors showing the total quantity of wood used in various forms per ton of ore mined by the Anaconda Copper Mining Company have been worked but will be rechecked in an attempt to separate the lumber used underground from that used for repairs and construction purposes on the surface. Figures on total tonnage of ore mined and total forest products used per ton of ore hoisted during the four-year period 1932 to 1935, by one of the largest mining companies in the Coeur d' Alene district of Idaho, have been obtained. Data showing



Field work in connection with the rural  
total volume of round stulls consumed in the  
metal mines of northern Idaho are now available  
but for plank lagging and other forms of lumber  
used it will be necessary to obtain additional  
records. Data on timber consumption and tonnage  
of coal produced by the coal mining companies at  
Roundup and Red Lodge, Montana, and coal produc-  
tion statistics for other coal producers in the  
State, to be used on a basis for estimation of  
total timber requirements, by use of conversion  
factors, per ton of ore mined, have been  
collected. Data obtained from the Federal Civil  
Works Administration, Farm Housing Survey, of  
value in the analysis of rural timber requirements  
have been tabulated and summarized. In addition  
to the information tabulated from the farm home  
schedules covering 4,804 farms in Montana and  
4,465 farms in Idaho, data taken from the  
"Engineer" schedules for 804 houses in these  
States have been worked up. Through the use of  
suitable conversion factors prepared and applied  
to the quantitative data shown by the Engineer  
Schedules, the total lumber requirements for  
repairs and additions to farm houses have been  
computed for each county in which this kind of  
sampling was done.

RESULTS  
OF PAST  
YEAR:



Field work in connection with the rural timber requirements survey has been completed. Final reports covering the fuelwood and the fence post requirements of the Northern Rocky Mountain Region have been prepared. Preliminary figures showing the total volume of lumber and logs contained in all farm buildings of the region; also the average annual volume of lumber and logs used for new construction and repairs during the ten-year period 1925 to 1934, inclusive, have been worked up.

RESULTS  
OF PAST  
YEAR:

The results of urban fuel surveys made in 38 cities and incorporated places of 1,000 population and upward in the Region, together with rural fuel survey records obtained by sampling approximately 500 farms, were summarized in the report by Hutchison entitled "Cutting Depletion and Requirements for Fuelwood in Region One", dated February, 1936. The detailed study of farm fence post requirements conducted in connection with the farm canvass and supplemented by records as to size of farms and rods of fencing, obtained from the Federal Land Bank of Spokane (farm loan application schedules) was completed. The results of this study are presented in the final report "Production and Consumption of Fenceposts in Montana, Northern



Idaho, and Northeastern Washington" by B. Blair Hutchison, dated March, 1936. A copy of each of the reports mentioned was mailed to Mr. Hallauer on June 13, 1936. During the first four months of the year, using NYA and ECW clerical help, computation and tabulation of individual building volumes for all buildings on the 500 sample farms was completed. After entering building volumes on each schedule for each building, the buildings were grouped into three general classes, "houses", "barns", and "sheds". Two different sets of tabulation sheets for use in analyzing and computing volume of lumber entering into the construction and maintenance of farm buildings were prepared. On one set were tabulated all of the farm samples for northern Idaho, western Montana, eastern Montana, and eastern Washington, separately by size of farms and types of construction. The other set of tabulation sheets headed "Lumber Requirements for Construction and Repairs, 1925-1934, Inclusive" covers only buildings constructed during the ten-year period 1925 to 1934. In this case, the data were also grouped by size of farms, with a column showing in addition to the new buildings the reported average annual board foot volume for maintenance and repairs for all farms in this group.



PLANS  
P. 1.  
1933:

Recently, conversion factor ratios between about lumber footages and building volumes were applied to average cubic volumes for each class of buildings in each farm acreage class. These data were then graphed. Values read from the lumber tally volume curves were applied to Bureau of the Census statistics as of 1930, giving number of farms and area of farm land in each of the following eleven classifications: Under 3 acres, 3 to 9 acres, 10 to 19 acres, 20 to 49 acres, 50 to 99 acres, 100 to 174 acres, 175 to 259 acres, 260 to 499 acres, 500 to 999 acres, 1000 to 4,999 acres, 5,000 acres and over. Using the same acreage size classes the sample farm data were also grouped under three general type headings, viz., "Grain Farms", "Stock Ranches" and "All Other Farms". Size of sample would not permit any more detailed grouping by farm types. The grand total, showing for the region, total volume of lumber used annually for new construction and repairs as derived from size and type curves, is approximately 15 percent higher than that based on size of farms alone. It is believed that volumes computed from the size and type may be the better set of figures to use. During the calendar year 1936, total effective time spent on the Requirements Phase of the Survey amounted



to approximately 18 man-months distributed about as follows: 2 months by Whitney, 2 months by Hutchison, 3 months by an ERA clerk, and 5 months of CCC help on computing.

PLANS  
F. Y.  
1938:

Recheck conversion factors obtained from bills of material for urban construction and apply them to the building records for the cities which have been sampled. After converting urban building volumes to board feet, compute total lumber requirements for both urban and rural residential and non-residential building construction in the region. Summarize records showing quantities and form of material used by city and county governments for which detailed records have been obtained. Analyze information furnished by the Montana State Highway Commission on total quantities of lumber and other forest products used on Montana State roadways, as shown by contract lettings for the year 1932. Compute volume of lumber required in State Highway Commission record but reported by contractors in the form of cost figures published in Bureau of Census reports "Construction Industry" (Idaho and Montana, 1929). At Bureau of Public Roads offices in Missoula obtain records on volume of forest products used in construction of forest highways, mileage of roads, etc., not covered by information from the Montana State



Highway Commission. Collect some road construction data from Idaho State Highway Commission, Boise, Idaho. An effort will be made to obtain this by mail. Obtain up-to-date lumber consumption data for several of the Coeur d' Alene mines. Obtain from Public Utilities Consolidated Corporation, Wallace, Idaho, also from the Interstate Telephone Company, Spokane, Washington, the Pacific Telephone and Telegraph Company, Seattle (division office Spokane), and the Home Telephone and Telegraph Company of Spokane, records covering mileage of lines and timber products used. After rounding up the information indicated above as lacking, analyze and summarize as far as time will permit all records of lumber and timber products used for purposes other than building construction. Unless considerably more money is available from emergency funds than last year, progress on the requirements study will be limited to what can be done by Whitney with some assistance from temporary employees on computing work.

ASSIGN-  
MENT:

M. Bradner, Regional Director, and C.N. Whitney.



PART  
THREE  
APPENDIX

DETAILED INFORMATION ON PLANS AND PROGRESS  
AND  
STATUS OF PUBLICATIONS



## DETAILED INFORMATION ON PLANS AND PROGRESS

### FOREST PROTECTION

Forest fire control on private, State, and Federal forest lands has in the past been largely an empirical rule-of-thumb procedure based almost entirely upon experienced judgment. Foresters located the types and quantities of physical facilities needed for fire control, such as lookout towers, smokechaser cabins, roads, trails, and telephone lines, where their best judgment and past experience dictated. There was no systematic procedure recognized either for determining the proper location or the total quantity of such facilities warranted on any area by the character of the fire problem peculiar to that area. It has always been recognized that these facilities are extremely expensive and that this cost is often a critical obstacle in the path of the practice of forestry. No technic existed, however, for planning this vital phase.

Likewise, no technic had been developed, tested in actual use, and found satisfactory for determining how many lookout men, smokechasers, guards, etc., should be stationed in the Forests at any particular time. Obviously, the costs of forest protection would be increased absurdly by maintaining at all times the maximum number of men needed when inflammability and fire danger is greatest.



If efficient protection is to be provided at least cost the protective force must be held to the minimum compatible with current fire danger.

With such a lack of methods no science of forest pyrology has ever been recognized even though this phase of forestry, protection from fire, is just as vital and perhaps more costly than protection from insects or fungi, for which there are recognized sciences of forest entomology and forest pathology. As one result of this lack, personal judgment concerning the proper procedures undoubtedly has resulted in mistakes which have been extremely costly in area burned-over, timber destroyed, and expense of fire suppression. Another result has been the impossibility of teaching in the forestry schools a system of planning protection from fire commensurate with that taught in forest entomology and forest pathology. There have been no texts thoroughly describing either the systematic planning of fire control facilities or the measurement of fire danger.

During the past year a definite step was taken by the Northern Rocky Mountain Forest and Range Experiment Station to remedy these deficiencies. A limited supply of a progress report entitled "Fire Control Planning in the Northern Rocky Mountain Region" was issued to meet the control on private, State, and Federal forest lands for



urgent need of the National Forests for a detailed description of the tested methods of fire control planning originated by this Station. A formal publication describing the major principles and technics of this work is now in course of preparation to meet the demand by the Forest Schools. Printing regulations prevent the Forest Service from making the progress report generally available. To supplement this contribution to better fire control and to the education of forest school students, U.S.D.A. Circular No. 398, "Measuring Fire Weather and Forest Inflammability" was published and made generally available. This report describes in detail the methods and technics of measuring fire danger as developed at the Northern Rocky Mountain Station, and as used officially in actual fire control practice on the ten fire Forests of Region One during the last three years.

These two research publications, on fire control planning and fire danger measurement, make available to practicing foresters a tested system of planning protection from fire which is a marked step toward a science of forest pyrology. As soon as the fire control planning report can be formally published, for public distribution, the Forest Schools will be able to graduate their men much better prepared to plan and to direct forest fire control on private, State, and Federal forest lands for



maximum efficiency at least cost.

One desirable improvement in the rating of forest fire danger is to be tested in 1937 as a result of intensive research conducted during the past two years. This is the incorporation of vegetative condition as one of the factors used on the fire danger meter. Detailed periodic observations and measurements of the volume and condition of several common grasses, weeds, and shrubs have shown a correlation with cumulative maximum temperature sufficiently dependable to permit use of the latter as an index. It was also found that departures of the cumulative maximum temperature, above 60° F., indicate the progressive drying and increased inflammability of fuels under dense timber canopy and on protected north slopes. The extent of this progressive drying is a pronounced factor in the character of a fire season; all critical seasons being marked by exceptional dryness and inflammability on the shaded and protected sites which normally retain relatively high moisture contents. The use of the cumulative maximum temperature index has been tested by application to data for previous years and found satisfactory. Before official adoption, however, a thorough test will be made at several stations in the rating of current danger during 1937.



Preliminary results are available this year, from our study of fire danger factors according to altitude and aspect, which show several basic and exceptionally important relationships. Some of these results are shown by charts 1 and 2, and these are, to the best of our knowledge, the first presentations of such information representing surface conditions ever made in either meteorology or forestry.

The striking fact revealed by these charts, and by others showing fuel moisture, wind, and class of fire danger, is that during a typical August day there are in northern Idaho three topographic or altitudinal strata which differ appreciably in fire danger. The lowest stratum, comprising the valley bottoms, experiences the most marked fluctuations of fire danger, and has the least danger of all strata just before sunrise.

At the other altitudinal extreme lies a stratum of some fluctuation, but lacking the marked before-sunrise safety. Intermediate between this and the valley bottom, occupying a zone approximately between 3,000 and 5,000 feet above sea level, lies a stratum in which both temperature and humidity are more dangerous at night than in any other stratum, and in which during the day all factors combine in August to produce higher fire danger than in either of the other strata. Obviously, in this inter-



Chart 1.-- **ISOGRAMS OF TEMPERATURE ON SOUTH SLOPES**  
**MEDIAN DAY OF AUGUST, 1936, ON THE PRIEST RIVER EXPERIMENTAL FOREST**

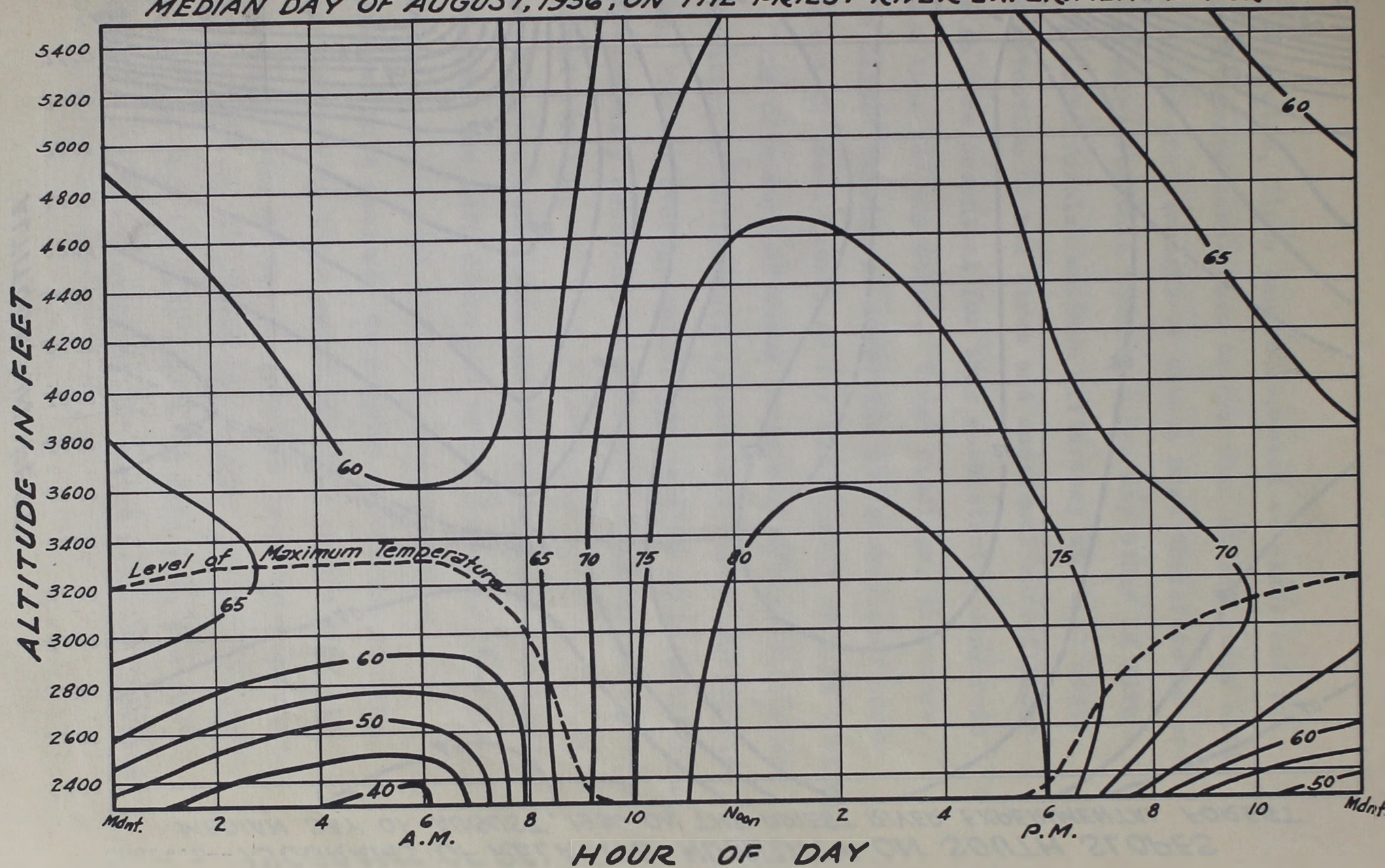
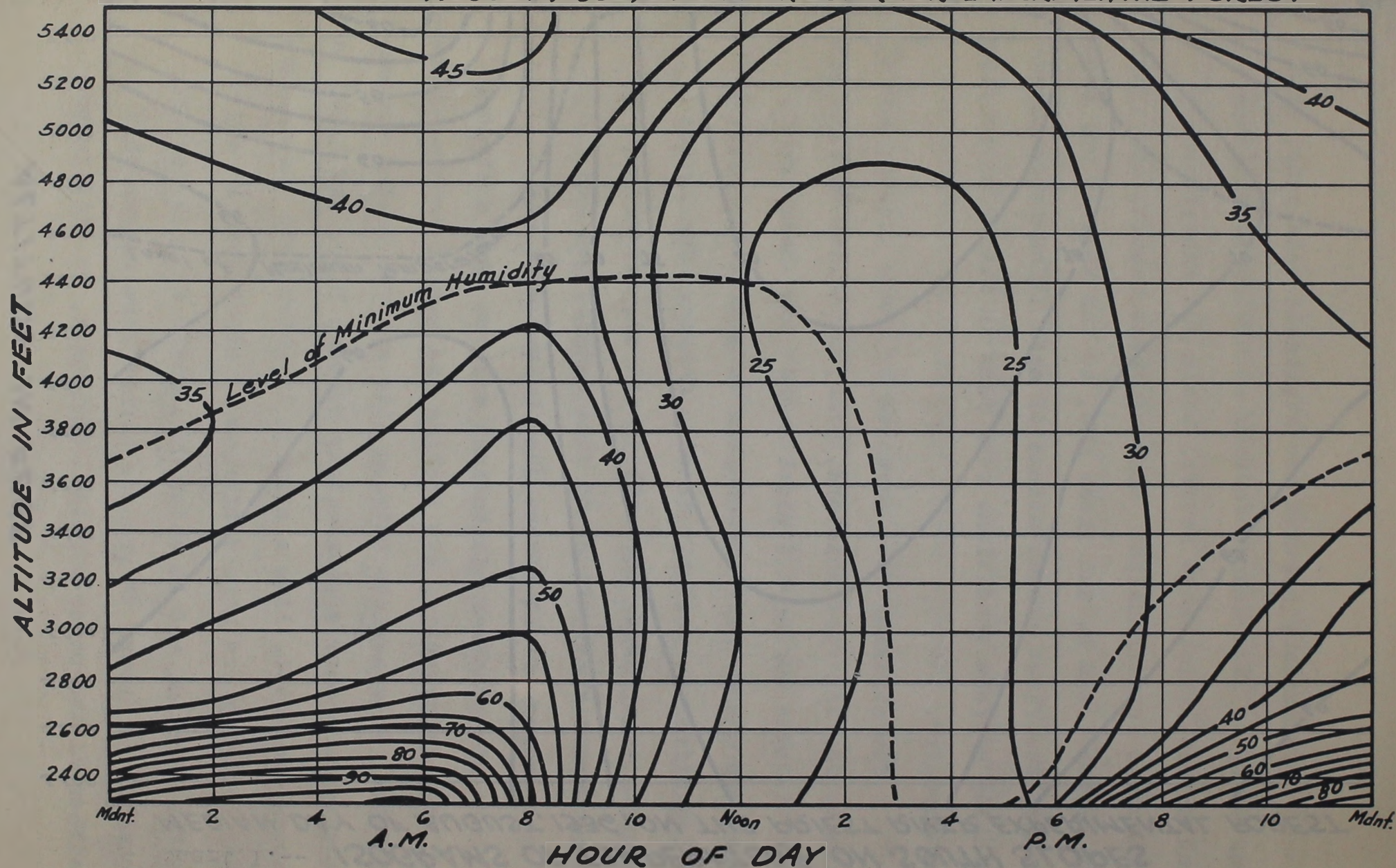




Chart.2-- **ISOGRAMS OF RELATIVE HUMIDITY ON SOUTH SLOPES**  
**MEDIAN DAY OF AUGUST, 1936, ON THE PRIEST RIVER EXPERIMENTAL FOREST**





mediate stratum, fires can be expected to start and to spread with more consistent danger than at any other altitude. Speed and strength of attack must therefore be provided greater for this zone than for any other if fire control is to furnish maximum efficiency at least cost. Quick detection of new fires and continual surveillance are also more essential for this consistently dangerous stratum than for any other. These findings, therefore, have a direct bearing on detection and smokechaser locations and on trail locations for the benefit of fire control.

The discovery of these three strata also influences the location of inflammability stations for measuring fire danger. If the average danger per acre is to be determined, it is obviously necessary to sample each significantly different stratum.

These data also show the vital importance of similar information for both north and south slopes if fire dispatching is to be most efficient and economical. A dispatcher must estimate dependably the status of fire danger factors at the site of the fire at the time his smokechasers will arrive there if he is to send sufficient but not too many men. Obviously, more men should be sent to a fire if they arrive at 6:00 A.M. and encounter an air temperature of 60° and a relative humidity



of 35%, then would be necessary for arrival at 6:00 A.M. with an air temperature of 40° and a relative humidity of over 90%. These differences occur between fires at elevations of 4,200 and 2,300 feet, respectively.

As previously stated, the data shown by the present charts are preliminary in that they are based upon measurements for only two seasons, on one particular ridge, with the stations in north and south pairs barely 100 feet below the ridge top. For most dependable use these measurements must be further verified on this ridge, they must be checked on other ridges, and they must be extended to sample conditions at increasing distances down the slope. Conditions on a south facing slope 100 feet above a creek bottom may be very different from those on a south facing slope 100 feet below a ridge top and perhaps 1,000 feet above a creek bottom even though both are at the same elevation above sea level.

## RANGE RESEARCH

### Range Management

The 1936 season, ranking next to 1934 as the most severe drought of record at Miles City, together with one of the hottest summers and the most severe grasshopper infestations combined to make it one of the most disastrous years in the history of eastern Montana.



### Weather Conditions

The 4-year period since this phase of the experiment started, includes the 1934 and 1936 droughts when annual precipitation at Miles City amounted to 40 and 44 percent, respectively, of normal and to 36 and 37 percent, respectively, of normal for the April-September growing season. These seasons stand out as the worst drought years in nearly 60 years of record. Soil dried to a moisture content ranging from 3.7 to 7.4 percent and remained at very low levels for long periods. In most portions of eastern Montana, grasshoppers were more destructive than ever previously recorded. Both 1934 and 1936 were abnormally hot summers and the winter of 1935-1936 was one of the most severe of record with a minimum temperature of  $-45^{\circ}$  and with one stretch of 21 consecutive days in February when the minimum at Miles City ranged between  $-5$  and  $-45$  degrees. Such conditions interfered materially with the normal course of this experiment.

### Data on Cattle

The reactions of three different lots of cattle, each grazed at a different intensity, are summarized in the following table.



Table 9.--Summary of feed costs and cattle production data

Summary, Four Years	20 Cows, Lot 1		20 Cows, Lot 2		20 Cows, Lot 3	
	Overgrazed Range		Moderately grazed		Lightly grazed	
	Amount	Cost	Amount	Cost	Amount	Cost
Acres range per cow <u>1/</u>	23.1		30.5		38.8	
Range cost, 10¢ per acre		\$184.80		\$244.00		\$310.40
Supplemental feed, hay - tons	89.0		66.17		60.48	
Hay, cost @ \$8.00		712.00		529.36		483.84
TOTAL COST, four years		896.80		773.36		794.24
Calf crop (number four years)	58		68		62	
weaned (percent, average)	72.5		85.0		77.5	
Average weaning weight <u>2/</u>	248.8		293.6		297.0	
Average calf weight per cow <u>3/</u>	180.4		249.6		230.2	
Total weaning weight, four years	14,431		19,966		18,415	
Feed cost per calf pound, cents		6.21		3.87		4.31
Comparative cost, with Lot 2 as 100 percent		160.5%		100%		111.4%

1/ Average grazing use about 11½ months except during 1934 and 1936 drought years.

2/ Normally, calves are weaned when approximately 6 to 7 months old, but were weaned at 4 to 5 months of age during two drought years.

3/ Total weaning weight of calves prorated to 20 cows.



From this table a sharp increase will be noted in the amount of supplemental hay feed required as the range allowance is reduced from approximately 39 acres for the lightly grazed lot to 23 acres for the overgrazed range lot. This increase far outweighs the saving made in range costs where only 23 acres are allowed per cow. The better calf crop and the greater average weaning weight of 44.8 to 48.2 pounds per calf helps to account for the fact that feed costs (range plus supplemental feed) were 60½ percent greater for calves produced on overgrazed ranges as compared to those from moderately grazed ranges. Weights as of August 7, when drought forced removal of all cattle from experimental pastures, are used here as weaning weights for 1936 even though a part of the calves were not actually weaned until September. The feed cost per pound for producing calves on range where 38.8 acres are allowed was 11.4 percent greater than where the range allowance was 30½ acres per cow. Probably most, if not all, of this additional 8 acres is needed as a safety factor during drought years.

The stable grazing capacity of this range may at this preliminary stage be considered as somewhere near the 39 acres per breeding cow even though 30½ acres gave slightly lower immediate costs. Additional penalties in the form of more rapid deterioration of cows, price



discrimination against thin calves and greater risks of operation are not reflected by the above table. In this case production costs over a 4-year period are greatly increased by heavy grazing in advance of clear evidence of range deterioration. Drought is a constant threat and cannot be prevented but ranges can be managed with foresight that will avoid many of its penalties.

#### Data on Vegetation

Based on 55 quadrats, the density of all important forage species except one has declined very greatly since 1933, as is shown by the following tabulation.

Table 10.--Actual area by species on 55 quadrats, 1936, in the Hogback and Lone Pine pastures.

Species (all intensities)	Total area -Cm <sup>2</sup>			: % : % change by inten-			change: sites of use,		
							1933-: 1933-1936		
	1933	1935	1936	1933	1935	1936	1933	Heavy:	Moderate:Light
Agropyron smithii	11,305	8,927	4,471	- 61	- 63	- 60	- 55		
Bouteloua gracilis	84,806	21,417	21,927	- 74	- 74	- 74	- 76		
Buchloe dactyloides	48,157	10,182	20,403	- 58	- 39	- 71	- 70		
Poa secunda	2,333	6,501	4,484	+ 81	+102	+ 77	+103		
Stipa comata	2,278	871	1,176	- 48	- 45	- 50	- 52		
Carex filifolia	2,730	2,393	1,563	- 43	- 47	- 32	- 89		
Others	10,984	3,102	4,794	- 56	- 66	- 29	- 58		
Totals	162,593	47,393	58,818	- 64	- 58	- 67	- 68		

1/ Including Quadrat A-6.



Computations for density based on averages for all quadrats give but slightly different results, as shown in table 11.

increase in total density during early 1936 was maintained

Table 11.--Average area of all vegetation in 1936 on quadrats in Hogback and Lone Pine pastures.

Pastures	Years				Change		
	1933	1934	1935	1936	Cm <sup>2</sup>	%	
Heavily grazed	2498	1761	795	842	-1656	-66	Quadrat A-6 omitted
Heavily grazed	2695	1761	822	1136	-1559	-58	Quadrat A-6 included
Moderately grazed	4047	2828	1017	1323	-2724	-67	
Lightly grazed	2325	1634	777	732	-1593	-69	

1/ One quadrat, A-6, was not charted in 1934. This quadrat is so located that it received unusual run-off after certain storms, as in 1936. Its composition is largely buffalo grass able to benefit more than ordinary from such fortuitous happenings. Including the data from this quadrat for comparisons is questionable.

The total decline in density for heavily grazed range since 1933, as computed in table 11, amounts to 66 percent if Quadrat A-6 is omitted, or to 58 percent if it is included. For moderately grazed and lightly grazed quadrats, the declines for four years amount to 67 and 68 percent, respectively, where actual areas are computed by species as in table 10 and to 67 and 69 percent when averages are used as in table 11. Similar figures for 1935 were 70, 75, and 68 percent, respectively. In view of the fact that charting was completed early in the summer, before the full impact



of the drought and grasshoppers had been felt by the vegetation, it is by no means certain that the slight apparent increase in total density during early 1936 was maintained through the year. Quadrats in winter pastures that were charted last, after the middle of June, showed consistent losses from 1935 totals.

With the exception of one species, all perennial grasses have shared in density losses since 1933. There has been no consistency between these declines and intensity of grazing. Poa secunda has been an outstanding exception to density trends as will be noted from table 10. It covered 81 percent more area in 1936 than in 1933, all intensities included. Oddly enough this species was in 1935 at its highest point in four years with 174 percent of its 1933 coverage. This particular little bluegrass thus has the unusual faculty of increasing during or immediately after drought years, but it gives away readily when other grasses tend to increase.

It should be clearly stated that these shortgrass ranges, that were in very good condition when the experiment started late in 1932, do not yet clearly show significantly greater or less deterioration under overgrazing than under lighter degrees of grazing use. The extent to which drought on the one hand and varying intensities of



Secretary Wallace in an AAA publication dated December 30, lists eradication of sagebrush as a desirable range practice without qualification. This endorsement that drought has completely obscured declines that might otherwise have been evident from varying intensities of grazing. The fact remains that the penalties of overgrazing the data are rather meager.

ranges of this experiment are reflected almost entirely in livestock production data to be summarized below, rather than in deteriorated ranges.

In this experiment the sagebrush (*Artemisia cana*) on several acres were grubbed, piled and burned late in 1933 and early in 1934. On another area of about 5 acres the sagebrush was burned standing in September, 1934, while an untreated area was left between the burned and plots, vigor, survival of grass seedlings on drought depleted areas and the effects of drought, grubbing and burning on sagebrush and of burning on *Opuntia*. With heavy drought losses. On 18 grubbed plots the average number of new plants per plot late in 1934 was 7.9 but only 3.4 bushes were alive in 1936. On 18 burned plots the exception of sagebrush burning, none of these studies have yielded sufficient data for final significant conclusions. However, it is of interest to note that the number of live bushes in the fall of 1934 but an average of 9.5 bushes in 1936. It is very evident from this that neither grubbing or burning destroys but may actually increase numbers of bushes. Thus, eradication perimeter of *Atriplex* bushes lost 1 percent of area on one plot and increased 13 to 18 percent on the other two.

During these two years, five new *Atriplex* plants became established. These data indicate that the latter species can withstand severe drought better than *Sarcobatus*. Of three burned sagebrush plots, paired with three untreated plots, two yielded more herbaceous vegetation and one less than untreated check plots while



Secretary Wallace in an AAA publication dated December 30, lists eradication of sagebrush as a desirable range practice without qualification. This endorsement of sagebrush eradication appears to warrant a preliminary statement from our sagebrush eradication study even though the data are rather meager.

In this experiment the sagebrush (Artemisia cana) on several acres were grubbed, piled and burned late in 1933 and early in 1934. On another area of about 5 acres the sagebrush was burned standing in September, 1934, while an untreated area was left between the burned and grubbed strips. The average number of bushes on 15 untreated plots was 14.8 in 1934 and 4.9 in 1936 showing heavy drought losses. On 18 grubbed plots the average number of new plants per plot late in 1934 was 7.9 but only 3.4 bushes were alive in 1936. On 18 burned plots there were no live bushes in the fall of 1934 but an average of 9.5 bushes in 1936. It is very evident from this that neither grubbing or burning destroys but may actually increase numbers of bushes. Thus, eradication of this species is not accomplished by one burning or by one grubbing plus burning.

Of three burned sagebrush plots, paired with three untreated plots, two yielded more herbaceous vegetation and one less than untreated check plots while



three grubbed plots all yielded substantially less grass encouraging. Like other range experimental work recent than their untreated companion plots. Furthermore, there studies were subject to very abnormal weather conditions. was unmistakable evidence of wind erosion on the burned The following table indicates something of the severity but little or none on unburned plots. It is not considered of recent drought conditions in eastern Montana, that these meager data prove greater production of herba-

ceous forage on the untreated sagebrush. However, it is clear that one grubbing or burning will not kill but may increase rather than reduce the number of Artemisia cana bushes. Chemical analysis agrees with experience of stockmen that this sagebrush is a highly valuable reserve feed on the range. Consequently, its eradication should not be endorsed without qualification as a desirable range prac-

tice. It seems questionable if it should be unqualifiedly endorsed even for Artemisia tridentata unless good manage-

ment following burning is assured that will allow the

herbaceous vegetation to increase and maintain itself.

Practically all perennial grass seedlings appearing after showers last summer succumbed to drought and heat before the end of the season.

#### Artificial Range Reseeding

Reseeding of mismanaged and depleted ranges is one of the major problems confronting western stockmen.

A brief resume at this time of the results obtained by reseeding experimental work at this Station is quite



Table 11.--Success of reseeding on various experimental areas.

encouraging. Like other range experimental work recent studies were subject to very abnormal weather conditions.

The following table indicates something of the severity of recent drought conditions in eastern Montana.

Table 12.--Precipitation at selected stations  
(U.S. Weather Bureau data)

Station	Normal	1934		1935		1936	
	inches	Inches	Dep.	Inches	Dep.	Inches	Dep.
Bozeman (A.C.)	17.69	10.54	-7.15	15.46	-2.23	12.78	-4.91
Helena	13.66	8.35	-5.31	6.88	-7.38	10.89	-2.77
Lewistown	18.40	14.09	-4.31	12.69	-5.71	13.04	-5.36
Billings	13.18	8.68	-4.50	11.14	-2.04	9.80	-3.98
Miles City	13.81	5.51	-8.30	11.54	-2.27	6.06	-7.75
Ingomar (near)	11.23	4.89	-6.39	10.41	-.87	4.29	-6.99
Roundup	12.20	7.77	-4.43	9.30	-2.90	7.99	-4.21

1/ As given in letter of February 4, 1937, from U. S. Weather Bureau Office at Helena, but figures believed to be "averages" rather than "normals", as they are at slight variance with published Weather Bureau normals.

The past two seasons have also been characterized generally by the worst infestation of grasshoppers and Mormon crickets ever known for many portions of eastern Montana. These pests provided another major handicap to successful reseeding. No high degree of success can be expected from cheap reseeding methods under such conditions.

Table 13 is arranged to show relative success of spring and fall reseeding for certain more promising species, based on best data available in the fall of 1936.



Table 13.—Success of reseeding on various experimental areas.

Fall seeding	All species **		Crested wheatgrass		Smooth bromegrass		Slender wheatgrass		Mixtures	
	Total	%	Total	%	Total	%	Total	%	Total	%
	acres	suc.	acres	suc.	acres	suc.	acres	suc.	acres	suc.
Coop. areas	405	35	270	46	39½	20	19	16	49½	18
Nat'l Forest areas	73	37	38	59	½				34	14
U.S.R.L. areas	98	15	70	14	2		2	46	7	41
TOTALS	576	32	378	41	42	19	21	16	90	18

1/ Actually crested wheatgrass should be credited with 1% higher success and mixtures with only 12% success because crested wheatgrass was the only survivor on 6 acres of the latter counted above as successful.

Spring seeding	All species **		Crested wheatgrass		Smooth bromegrass		Slender wheatgrass		Mixtures	
	Total	%	Total	%	Total	%	Total	%	Total	%
	acres	suc.	acres	suc.	acres	suc.	acres	suc.	acres	suc.
Coop. areas	678	24	427	32	48	12	13	19	94½	11
Nat'l Forest areas	47	27½	24	32	½	100			22	3
U.S.R.L. areas	83	13	56	17	3½		3		11½	
TOTALS	808	22½	507	30½	52	12	16	16	118	9
Grand Totals spring and fall	1384	26½	885	35	94	15	37	16	208	13

\*\* All species includes tall oat, meadow fescue, perennial rye, Kentucky and Canada bluegrass, Lespedeza and several others.



The foregoing results are based on examinations made in the fall or late summer of 1936, at which time it was impossible to make an accurate appraisal of the success in some cases. Those areas that appeared to be on the border line were classed as failures so that the above figures on success are more likely to be revised upward than downward with a favorable season in 1937. In recent examinations a number of fields have been reclassified as successful that were previously classed as failures. No data are available on 159 acres seeded in the fall of 1936, largely on National Forests.

The relative success of crested wheatgrass is outstanding. Counting both spring and fall seeding, 35 percent of 885 acres are classed as successful. Fall seeding with 41 percent success on a total of 378 acres ranks well above spring seeding with only 30 1/2 percent success on 507 acres. Fall seeding gave equal or slightly higher success for other species also. Fall seeding is accordingly favored at least during drought years where little or no soil preparation is done, as is true for most of the acreage covered.

The major part of this was seeded without soil preparation and at the rate of 3 to 8 pounds per acre. Five pounds per acre was the maximum aimed at but this was exceeded in a few cases.



A deep furrow-type drill has been ordered for use in 1937 in an effort to improve survival from spring drilling with the usual disk type used heretofore.

Considering the competition of existing vegetation and the lack of or very slight degree of soil preparation, the success of 59 percent for fall seeded areas on National Forests indicates that reseeding at a low cost is quite feasible on such areas. The same may be said of 46 percent success from fall seeding on a considerably larger acreage of cooperative areas. These are nearly all located below 3500 elevation and where the effects of drought and grasshoppers were very severe. The grazing capacity of all the successfully reseeded areas have been increased materially--in some cases several hundred percent.

Even with 46 percent success and created wheatgrass at 50 cents or more per pound, it cannot be said that range reseeding is economically feasible for the private owner of depleted range land of very low productivity. With seed at half this price, however, the private owner of the better class of range land can afford to risk 3 to 5 pounds of created wheatgrass in each of two trials, if necessary, on the chance of increasing the grazing capacity from 100 to 500 percent.

sequent occupation of a good share of his time with developmental and administrative work.



Concurrently with the completion of the manuscript

### SILVICS

program, a careful review of the field of silvicultural

A considerable share of the time of the Silviculture research at this Station is being instigated along two Division during the past year has been devoted to manuscript major lines: (1) to answer the question "where do we go from here?" and (2) to critically evaluate going projects. Establishment of Western White Pine and Associated Species" Until this review is made, the Division of Silviculture by I. T. Haig, and "Timber Growing and Logging Practice in Ponderosa Pine in the Northwest" by R. H. Weidman are in print. Weidman's manuscript on "Racial Influences in a 25-Year Test of Ponderosa Pine" has been submitted for publication. A report by Davis, "Stand Improvement Measures for the Western White Pine Type" has been mimeographed. However, several manuscripts must yet be completed to clean the slate of proposed publications, and their preparation will occupy an important share of the coming year. Progress in manuscript preparation has been slowed because (1) a good share of Hornby's time has been devoted to fire control planning work which has resulted in the completion of his important publication "Fire Control Planning in the Northern Rocky Mountain Region"; (2) assignment of Weidman to a new project, Reforestation; (3) Wellner's assignment as superintendent of the Deception Creek Experimental Forest and the consequent occupation of a good share of his time with developmental and administrative work.



Concurrently with the completion of the manuscript program, a careful review of the field of silvicultural research at this Station is being instigated along two major lines: (1) to answer the question "where do we go from here?" and (2) to critically evaluate going projects. Until this review is made, the Division of Silviculture is not ready to recommend major new projects.

### Management

Yearly observations of western white pine cone crops as observed on tagged trees on a number of permanent sample plots, mostly established in 1937, and supplemented by more extensive cone crop observations in 1935 and 1936 have yielded a fair working knowledge of the quantity and frequency of seed production. Recent summarization of seed production data has brought out the following important facts.

1. Trees of good vigor, i.e., trees with good crowns, rate of growth, and general indications of good health, bear from two to seven times the seed borne by poor vigor trees of similar diameter.

2. Few trees less than 14 inches in diameter in outover stands are effective seed producers. Good vigor trees become effective seed producers at about 14 inches.



Fair vigor trees less than 20 inches in diameter are seldom effective seed producers. Over 20 inches fair vigor trees approach but do not equal the productivity of good vigor trees. Poor vigor trees are usually ineffective seed producers at any diameter.

3. Cone production is distinctly periodic. Based on a 28-year record, good cone crops are produced every third or fourth year on the average. However, production by individual stands or localities is highly variable and good crops have been observed to appear at from 2 to 10-year intervals.

Tables have been prepared from which the seed production of a white pine seed tree of given diameter and vigor class can be estimated. This information is needed to determine the number of seed trees that must be reserved to adequately regenerate an area after cutting.

Considerable progress has been made in the formulation and application of stand improvement measures in the western white pine type. In cooperation with the Region One Division of Timber Management available information on stand improvement measures in both immature and mature stands was assembled and a manual "Stand Improvement Measures for the Western White Pine Type" prepared. This manual outlines in practical fashion what is now considered to be best practice in the type and has been widely circulated in the white pine National Forests, where it has been



followed up by personal visits to a number of stand improvement operations on the Forests to help put this information into practice. Close contact with administrative men has been established, and it is believed that this cooperative work has been well worth while in putting silvicultural information into practice.

### Forestation

Research in forestation, inactive since 1926, was resumed in July, 1935, in cooperation with Region One. A real research need is indicated by the fact that for 25 years of administrative planting survival of ponderosa pine and western white pine five years after planting has averaged less than 50 percent. It has also recently become apparent that research of an intensive nature is urgently needed at the Savenac Nursery, Haugan, Montana, where the planting stock is grown for use on the National Forests of the Region. Physical and chemical soil difficulties are being encountered there with increasing intensity. Present activities designed to materially enlarge the facilities of the nursery are bringing these difficulties into sharp focus.

With the present low survival in field planting and coincident recognition of unsolved technical problems in the nursery, it is evident that there is great need for a complete investigation of planting activities in



this Region. There are now extensive areas within the boundaries of the National Forests which the Region plans to plant as rapidly as possible. A considerable part of the lands now being donated to the Forest Service are logged off and burned over and will have to be artificially reforested. The problem is thus increasing in scope and importance.

To undertake either field or nursery investigations alone upon the general problem of planting in this Region will constitute a truncated mode of attack. There is needed a complete and critical analysis of every step in the entire planting process, from the gathering of the seed to the final survival or death of the tree in the field.

Effort during the past year has been directed to an exploratory investigation of causes of low survival in field plantations. Effect of carefulness in planting was investigated by planting some 1,800 trees with special care in rows besides trees planted by the regular crew. Emphasis was placed upon tamping, depth of hole, sod, shade, and exposure of roots in handling. October survival of carefully planted stock averaged 11.8 percent better than regular crew planting.



Due to lack of cold storage facilities for holding stock dormant awaiting shipment, leader growth on some stock reached 2 to 5 inches before planting late in the season. A large proportion of these leaders were either broken off in handling or wilted after planting. October survival of this stock was 8 to 15 percent less than comparable dormant stock planted at the same time.

Planting too late in the spring was found to be another cause of planting losses in Region One. Survival in October on sample plots planted in early, mid and late season was 10 to 19 percent better on the early than on the late planted plots. Although the latter part of the 1936 planting season was more favorable than usual, it seems rather certain that some losses are due to planting too late in the spring.

Comparative survival of four grades of ponderosa pine stock, segregation based on top-root ratios, was investigated in a 4 x 4 latin square plot. In October no significant differences in survival could be detected between the three better grades for either 1-2 or 2-0 stock. Survival of the poorest grade was very significantly low, however, being from a half to one-fourth of the average of the three better grades. This preliminary investigation shows definitely the need of further and



more intensive study of grades of stock in relation to field survival.

Root penetration of the same four grades of stock was measured on sample trees (500 at Priest River, 300 at Savenac Nursery) excavated at 10-day intervals during the summer. Soil moisture determinations at 3-inch levels were made at the same time. Partial compilations to date indicate little difference between the three best grades, but a distinctly inferior root penetration of the poorest grade. This grade of stock is so slow in starting root growth after planting that it has little chance of keeping its roots below the seasonally dropping level of wilting-coefficient moisture.

All the installation of 1936 showed better survival for the 1-2 stock than for 2-0 stock. This agrees in general with previous experience in this region. The difference, however, is not great. The important need is to ascertain where and under what conditions use of the less expensive 2-0 stock will be satisfactory in lieu of sturdier but more costly transplant stock.

A somewhat unsuspected finding during the season was that one-fifth of the first-season mortality occurred before the soil moisture 8-10 inches below the surface had dropped below 20 percent. Many of the early deaths occurred during the first few weeks while the soil moisture



was still between 30 and 75 percent. In a few cases the cause is known to have been poor stock which suffered from heeling-in over the winter. In most cases the cause is unknown, but believed to have been poor condition of the stock upon delivery to the planters, probably through improper handling. It is important to know the amount of this loss, but more important to segregate it from summer losses and thus open it up definitely to investigation of causes and corrective measures.

Reforestation of portions of 200,000 acres of highly productive cutover and burned over lands recently donated to the Forest Service presents a real planting problem. On a 75-acre area, a hard burn in October, 1936, was tried as a method of killing the brush preparatory to planting. Parallel strips cleared with a bulldozer in the fall of 1936 on 4 acres outside the burn were planted last spring. Both ponderosa pine and western white pine were used. October survival averaged 80 percent. Further experimentation to devise effective and economical planting methods is needed.

Further research of direct seeding as a possibly less expensive method of reforestation is needed on the burned areas of Region One. Examination in September of a preliminary set of small plots, sown the previous



fall in a one-year-old burn, without rodent protection of any kind, revealed almost complete failure. In October, 1936, the following sowing plots were installed in a 1,700-acre area which was slash-burned in September: (1) a 4x4 latin square testing four seed-spot treatments with western white pine, alternate spots being screened against rodents; (2) three replications of sets of three plots 400, 800, 1,200 feet from green timber, each plot containing 20 seed spots of western white pine, ponderosa pine, and Engelmann spruce, and each fourth spot screened.

A project containing 22 plots testing that number of progenies of ponderosa pine from widely separated localities throughout the West is now 25 years old. Compilation and analysis of field records of height, diameter, survival, and foliage characteristics, including external and internal structure, have been made and a manuscript has been prepared and edited for publication. Striking differences were found between different localities of seed origin showing hereditary influences upon growth, form, survival, and foliage. Adaptability of certain races to northern Idaho and the localities best suited for seed collection are indicated. Seed collection from six progenies in 1936 offers the possibility of testing the second generation in the new environment.



### Botanical Studies

The Station's arboretum started in 1932 contains 40 species, mostly exotics, having a reasonable chance of surviving in northern Idaho. Species are planted in blocks of 1/4 to one acre to produce closed stand conditions. Small lots of stock of 15 species are now being grown in Savenac Nursery. The most interesting of these are the following five needled pines: *Pinus excelsa*, *P. koraiensis*, *P. oembra sibirica*. *Pinus excelsa* is believed to possess some degree of blister rust resistance. *Pinus peuce*, also reputed to be blister rust resistant, is already fairly well established in the arboretum. The Forest Survey is

### New Work

in urgent need of information on cedar increment in virgin and partially cut areas. If funds are available, Completion of the manuscript program and the need for a thorough overhaul of the project setup precludes initiation of much new work during the coming year. No new projects are planned for the coming year. However,

three new studies are planned under going projects and it is hoped that they can at least be started within the next year.

1. Study of economic aspects of silvicultural application in the western white pine type. A careful analysis of the probable results both economically and ing 12 acres of broadcast burned area to western white



silviculturally of different intensities of management practice. Study to be built around a specific white pine unit along case study lines. This study should help to determine the best intensity of management practice under given conditions and suggest definite needs for silvicultural research. This will be undertaken jointly with the Division of Products. See Products Logging and Milling status sheet.

2. Preliminary study of light intensities under stands of varying density and composition on different slopes and aspects.

3. Cedar increment study. The Forest Survey is

in urgent need of information on cedar increment in virgin and partially cut areas. If funds are available, silviculture plans to conduct study in partially cut stands; Forest Survey in virgin stands. See status sheet "Growth Phase" of Forest Survey.

Miscellaneous

The Deception Creek Forest has rapidly developed as a major center for silvicultural experiments. Management work during 1936 on this area resulted in broadcast slashing defective unmerchantable trees on 22 acres, in broadcast burning felled material on 26 acres, in planting 12 acres of broadcast burned area to western white



research aims to supply data on production costs, not re-  
pine, in completing a thinning project and burning slash  
in fire lanes on 20 acres of thinning area, in pre-logging  
disposal of low value trees on 16 acres, and in slash  
burning on 15 acres of pre-logging disposal area. Logging  
slash was piled and burned on 40 acres of timber sale  
area. Low value species were felled and the brush burned  
on 10 acres of shelterwood strip cuttings.

More than a million feet board measure of western  
white pine were logged from the Experimental Forest area  
during 1936, bringing the total amount of timber cut from  
the Experimental Forest to more than three and one-quarter  
million feet.

#### FOREST PRODUCTS

Forest Products research work deals largely with  
the economic problems of the timber owners of Montana,  
Idaho, and northeastern Washington. Only about 10 percent  
of the work deals with the orthodox Forest Products prob-  
lems of the Region. This is because the more pressing  
problems are economic problems caused equally by (1) lack  
of fundamental facts and their application, and (2) handi-  
caps imposed by our economic structure. Forest Products



research aims to supply data on production costs, net returns and other facts fundamental to proper forest exploitation and to make practical demonstrations of their application.

Such facts have an important bearing upon the financial aspects of Idaho white pine.

#### Scope of Work

All individual research projects may be classified under the following major work projects.

#### 1. Production Costs and Utilization Investigations.

- a. Logging and milling studies.
- b. Species utilization.
- c. Woods and mill utilization.

#### 2. Statistics of Production, Consumption Distribution and Selling Value of Forest Products.

#### 3. Investigations of Wood Treatments, Coating, Paints, Glues, and Laminated Construction.

#### Resume of Projects

**Logging and Milling.** A study of considerable importance to timber owners in the white pine type of Idaho was brought to its final stages during the year. As a result of this study detailed production cost, value and pertinent utilization data will soon be available on all steps involved in the utilization of Idaho white pine for matches from the tree to the finished match splint. This study has indicated that trees 14 inches and smaller have little value to the operator majoring in match plank production. Only 29% of their total lumber yield is usable



match plank and this plank yields 61 percent of acceptable match blocks. Larger trees, those 25 inches and over, produce 69 percent of match plank and the plank yields 66 percent of blocks. Such facts have an important bearing upon the financial aspects of utilization of Idaho white pine for matches. The final results of this study will be published and distributed during the coming year.

**Species Utilization.** Information on the properties and general utilization of lodgepole pine has been obtained preparatory to the publication of a bulletin. It is recommended that this project be discontinued because of a material reduction of the lodgepole pine utilization problem due to widespread insect infestations and lack of funds and personnel to do the work.

**Statistics.** A revised report on "Stumpage Prices Since 1912" was completed and distributed in mimeograph form to a selected mailing list of 105 names, principally Inland Empire lumbermen and timber owners. Price data were shown for Montana and Idaho by years for all commercial species and segregated for the following agencies, State Foresters, Indian Service, Forest Service, and Forests, sawmill operators.

Another statistical publication showing lumber production for the various subdivisions of Region One



of the Forest Service showed lumber production by species for each year since 1899. This was well received by commercial lumbermen and foresters and is planned for a revision, annually showing current production.

At the request of a member of the Montana Legislature a canvass was made of Christmas tree production in Montana which indicated that 1,262,500 trees were produced in 1936 for the commercial trade. The Christmas tree harvest has developed to an important industry in a few western Montana communities, particularly Eureka, a typical "boom and bust" lumbering town, where thousands of acres of cutover lands now produce an annual winter grub-stake payroll of approximately \$30,000.

Wood Preservation. In addition to work done in collecting service test data in 1936, the Products Division cooperated actively with the Regional Engineering and Procurement and Supply Divisions and Forest Supervisors on questions pertaining to the purchase and application of wood preservatives and in the selection of equipment needed in the construction of three new open-tank treating plants of large capacity established on Region One National Forests. In connection with a review of the treating section of a proposed new Forest Service Telephone Manual, the Engineering Division was furnished a comprehensive resume of service



records on the use of Anaconda Wood Preservative in this Region, including some data on the experiences of commercial companies. Suggestions and recommendations by Whitney, covering several cases where treating plant operators had encountered special problems, were mimeographed and distributed to Forest Supervisors. Under a greatly expanded Forest Service program, thousands of treated telephone poles, fence posts, corral and fence poles are now being used in the telephone lines and range improvements of Region One. In all, wood preserving activities occupied about 12 percent of Whitney's time during the year.

**Miscellaneous.** A comprehensive report dealing with prevailing exploitation practices and problems in the Inland Empire and recommendations for the improvement of these practices was prepared in collaboration with private foresters of the Region and submitted to the Society of American Foresters meeting at Portland. Similar reports dealing with the southern pine region and coast fir have been submitted to the Society at previous meetings.

The Forest Survey organization at this Station plans to cover the entire Northern Rocky Mountain Region. The Inland Empire region of the Pacific Northwest has been set up as the first unit to be worked. This unit includes the



forested area in Montana west of the Continental Divide,  
Idaho north of the Snake River and Spokane, Stevens,  
and Pen

### FOREST SURVEY

The Forest Survey is an economic study of the timber supply situation from both the national and regional viewpoint. It is a study of present supply with relation to local industry, transportation and finance, and an attempt to forecast future supply and possibilities from an analysis of depletion and growth trends, all in the light of domestic requirements, present and prospective, for forest products. When completed, the following results will be available.

1. Inventory Phase: The area of each type of forest cover and the estimated stand by species. Regrowth conditions on cutover and burned lands will be determined.
2. Depletion Phase: Rate of depletion by cutting, fire, insect, disease, and any other factor.
3. Growth Phase: Growth rate in old stands and on restocking areas and probable future yields.
4. Requirement Phase: Present national and local requirements in forest products and probable trends.

The Forest Survey organization at this Station plans to cover the entire Northern Rocky Mountain Region. The Inland Empire region of the Pacific Northwest has been set up as the first unit to be worked. This unit includes the

b. Classification of the present stand according



forested area in Montana west of the Continental Divide, to its accessibility for conservation. Idaho north of the Salmon River, and Spokane, Stevens, and Pend Oreille counties in northeastern Washington. Montana east of the Continental Divide, and Harding County, South Dakota, will be covered as the second unit. The Northern Rocky Mountain Region contains approximately 37 million acres of forest land. Sixty percent of the above area, or 22 million acres is in National Forests. Inventories of varying degrees of intensiveness have been made of the forest resources within these National Forests. All of the Forests, however, need some checking and additional information to bring them to Survey standards and several require practically a complete job of type mapping in place. At the start of the project practically no information, except that of estimates on merchantable timber, was available for the 15 million acres of public and privately owned forest land outside the National Forests.

Progress on the several phases of the Forest Survey in this Region follows.

#### Inventory Phase

The Inventory Phase of the Forest Survey consists of:

- a. Determination of the area of each type of forest cover and the estimated stand by species.
- b. Classification of the present stand according



to its accessibility for conversion.

c. Forest cover maps. Two-inch-to-the-mile detailed township type maps, one-inch-to-the-mile unit detailed type maps, and ultimately generalized State and Regional type maps.

d. Determination of regrowth conditions on outover and burned lands.

e. Classification of the forest area according to ownership and use policy.

f. Classification of forest area according to its forest productivity.

Collection of cruise data for the Survey was started in January, 1932. Field work was initiated on a small scale during the 1932 field season. Since that time the work has progressed on a fluctuating scale, both in the office and the field. Less funds have been available each year since 1934 and the efficient temporary organization that was then developed has since that time been badly dissipated for lack of regularly allotted funds.

Progress of the Inventory Phase of the Survey, Table 8, lists under the heading "Percentage of Job Completed" six major divisions of work of the Inventory Phase of the Survey. "Collection" represents the work of assembling and sorting the forest information available from the various sources, both private and public.



"Field Mapping" is the work of covering areas for which no satisfactory information is available and supplying missing data such as age and site on areas of mature lar timber where volume data alone have been obtained. but on "Adjustment Cruising" consists of checking the collected cruise estimates in the field and adjusting them to a common standard. "Office Compilation" is the job of welding the mass of information obtained by collection and field work into a complete summary of volume and type area data for the entire acreage of forest land within the region. "Maps" deals with the preparation of two-inch-to-the-mile township type maps in color, and the one-inch-to-the-mile unit type maps for all the acreage mapped in the field to date. "County Reports" is the job of writing up in report form the forest statistics for each county as they become available through office compilation. The "Percentage of Job Completed" for the first three divisions of work, "Collection", "Field Mapping", and "Adjustment Cruising" are based on the total area of forest land within the respective units. The "Percentage of the Job Completed" for "Office Compilation" and "Maps" is based on the amount of field work that has been done to date. The "Percentage of the Job Completed" for the "County Reports" is based on the number of reports that must be prepared. A study



of table 14 will give a fair picture of progress to date of this phase of the Survey.

An allotment of emergency funds somewhat smaller than in 1935 allowed the work to progress in 1936, but on a smaller scale than during the previous season. As planned, a bulk of the funds were used for adjustment cruising. Only three men were available for mapping in place during the summer field season. These men mapped approximately 550,000 acres of which 365,000 acres were in North Idaho and 185,000 acres were in western Montana. The summer of 1936 saw the field mapping completed in North Idaho and northeastern Washington.

#### Check Cruising

Five temporary cruisers under the direct supervision of Associate Timber Expert Pratt adjusted the collected State and public estimates for all of North Idaho and northeastern Washington. The crew also made a 10 percent cruise of some 41 million feet of timber in the Kaniksu National Forest. During the field season this crew made a 10 percent cruise of some 51,000 sample acres and estimated over 960 million feet of timber. Associate Director James Girard spent approximately five weeks in the Region checking the work of the adjustment cruisers and the volume tables in use.



Table 14.—Status of Inventory Phase of Forest Survey on March 1, 1937

				Percentage of job completed							
Unit	: Estimated area of forest land in M acres			: Based on total acreage of forest land : Based on field work done to date : Based on no. reports							
	: Inside : Outside:		Total	: Collec-: Field : Adjustment:			: Office : Unit maps: County				
	: National:National:			: tation :mapping: cruising :			: compilation: 2" : 1" : reports				
	: forest : forest :			: tion :mapping: cruising :			: compilation: 2" : 1" : reports				
Northeastern	:	:	:	::	:	:	:	:	:	:	:
Washington	:	331 :	2,530 :	2,861 ::	100 :	100 :	100 :	100 :	100 :	100:	67
North Idaho	:	6,220 :	4,383 :	10,603 ::	100 :	100 :	100 :	70 :	100 :	85:	20
Western Montana	Deerlodge	:	60 :	15 :	75 ::	90 :	:	:	:	:	:
	Flathead	:	1,843 :	1,123 :	2,966 ::	100 :	35 :	:	43 :	100 :	60:
	Granite	:	620 :	133 :	753 ::	75 :	:	:	:	:	:
	Lake	:	:	442 :	442 ::	90 :	25 :	:	60 :	100 :	50:
	Lewis & Clark	:	140 :	80 :	220 ::	90 :	:	:	:	:	:
	Lincoln	:	1,655 :	624 :	2,279 ::	100 :	85 :	:	88 :	100 :	80:
	Mineral	:	576 :	164 :	740 ::	75 :	:	:	:	:	:
	Missoula	:	567 :	853 :	1,400 ::	85 :	:	:	:	:	:
	Powell	:	515 :	390 :	905 ::	95 :	:	:	:	:	:
	Ravalli	:	928 :	153 :	1,081 ::	80 :	3 :	:	:	100 :	:
Sanders	:	822 :	452 :	1,284 ::	80 :	25 :	:	61 :	100 :	60:	
Silver Bow	:	25 :	25 :	50 ::	:	:	:	:	:	:	
Total Western Montana:	:	7,751 :	4,444 :	12,195 ::	89 :	28 :	:	70 :	100 :	50:	
Total Inland Empire	:	14,302 :	11,357 :	25,659 ::	95 :	66 :	53 :	93 :	100 :	81:	20
Eastern Montana	:	7,630 :	3,589 :	11,219 ::	40 :	none :	none :	none :	none:	none:	none
Northern Rocky Mountain region	:	21,932 :	14,946 :	36,878 ::	78 :	46 :	32 :	73 :	100 :	81:	8



The comparisons between the Survey cruise and the cruises of the large private owners were very close, particularly for the major species. The Survey cruise raised most of the large private cruises on an average of 10 percent to 15 percent on the major species, due to more intensive cruise specifications on the Survey. In some areas the Survey cruise lowered the private cruises due mainly to fire, disease, or insect damage which had occurred since the estimates were made. The cruises of the various public agencies checked out in the same satisfactory manner.

#### Maps and Reports

Two-inch-to-the-mile township type maps in color have been prepared for all of the acreage mapped to date in the field. These maps contain all of the inventory data, except volumes, collected by the field mapping crews. Four E.R.A. relief rollers and one C.C.C. boy worked on map tracing and map coloring during the past year. Excellent progress was made on the one-inch-to-the-mile unit type maps by the two emergency draftsmen assigned to the job. Unit type maps have now been prepared and colored for 80 percent of all the acreage mapped to date. These unit maps are 30" x 48" compilations which contain an average of 40 townships. They and write up the results from the data already collected.



form a complete and usable cover map of the forest land area.

During the past year an office force of six E.R.A. relief rollers and one C.C.C. enrollee under the supervision of an E.C.W. technician have been working on the compilation of field data. During the present winter this crew has been increased by the addition of six field men, all of whom are E.C.W. technicians. By March 1, 1937, this office force will have compiled the acreage and volume data for approximately 73% of all field data collected to date. Since November, 1936, Junior Forester S. B. Hutchison has been assigned to County Report writing and four such reports are ready for field printing (March 1, 1937).

#### Plans for the Future

With the recommended increase of \$10,000 to the regular Forest Survey funds for F.Y. 1938, it will be possible to provide in addition to the present regular overhead of three men, a man to take charge of adjustment cruising, a Junior Forester to head up the County Report writing, three field assistants for a 3-4 months' field season, and the Division's share of the Station's overhead expense. If no emergency funds are allotted, further field work on the Inventory Phase of the Survey will be out of the question and the small surplus of funds in the regular allotment will be used to compile, analyze and write up the results from the data already collected.



If, however, emergency funds (including E.R.A., C.C.C., as well as E.C.W. Research) equal in amount to those provided the Survey project during 1936, are made available during the present year, it will be possible to do the following jobs:

1. Map in place in the field in western Montana approximately 2,880,000 acres of forest land.

2. Adjust the collected State, private and Indian Service cruises in all of western Montana and make the most urgent adjustments needed within the National Forests. To date work has been done on only three of the several factors, viz., cutting, fire, and insect depletion. Most of the data for determining the annual depletion by cutting had been collected by the end of 1935 and these data were compiled and analyzed early in 1936. A progress sample acres.

3. Prepare two-inch-to-the-mile township type maps in color for all acreage mapped during 1937. Complete the one-inch-to-the-mile unit maps for all of the acreage mapped up to the end of the 1937 field season.

4. Finish the compilation of acreage and volume data for the North Idaho and northeastern Washington units and prepare the remaining nine County Reports.

Emergency funds for the entire Survey project allotted during 1936, were as follows:

E.C.W. Research - \$29,000 for nine months' period.  
E.R.A. relief rollers - average crew of eight.  
C.C.C. enrollees - average crew of two.

has been done since 1935-36. It is estimated that a reliable figure on the epidemic insect losses within the



Northern Rocky Mountain Region should be obtained for around \$10,000.

### Depletion Phase

The objective of this phase of the Forest Survey is to determine the average annual rate of depletion to the green timber stands of this Region by cutting, fire, insects, disease, or any other factors. by the Survey organiza-

tion on epidemic disease losses within the Region, the

### Progress to Date

western office for white pine blister rust control have

To date work has been done on only three of the collected together a great deal of information on losses several factors, viz., cutting, fire, and insect depletion. from this particular disease. Arrangements are being made

Most of the data for determining the annual depletion by with the Spokane Blister Rust Control Office to furnish cutting had been collected by the end of 1935 and these the Survey with detailed figures on this loss.

data were compiled and analyzed early in 1936. A progress

report entitled "Cutting Depletion in the Northern Rocky

Mountain Region Including Sawlog Depletion in Southern

Idaho" by S. B. Hutchison and C. N. Whitney was published

in October, 1936. North Idaho has been completed. During

the 1936 field season, three months were spent by two

men on the fire depletion study in North Idaho. Field

work on the fire depletion study was completed. The work is done in

entire field season of 1935 on an insect loss survey in

North Idaho covering three-fourths of northern Idaho. examination for spruce, clearcut, and other

The work of compiling and analyzing the field data col- is well along, but as yet not completed. The field work

lected was completed in March, 1936. Due to a lack of was done in Nezperce, Lemhi, and Blaine counties. It is

sufficient Survey funds, no further work on insect losses estimated that field work for the entire region can be

has been done since 1935-36. It is estimated that a re- completed in about 18 more months. If the same amount

liable figure on the epidemic insect losses within the



Northern Rocky Mountain Region could be obtained for around \$10,000. No work is planned for 1937 on this phase of the Survey unless considerably more emergency funds than were allotted in 1936 are made available during 1937.

Though no work has been done by the Survey organization on epidemic disease losses within the Region, the western office for white pine blister rust control have collected together a great deal of information on losses from this particular disease. Arrangements are being made with the Spokane Blister Rust Control Office to furnish the Survey with detailed figures on this loss.

#### Depletion From Fire

Some work has previously been done on the fire depletion phase of the Survey. The office collection of data for all of North Idaho has been completed. During the 1936 field season, three months were spent by two men on the fire depletion study in North Idaho. Field work on 133 fires was completed. The work is done in Boundary, Bonner, Benewah, and Kootenai counties. Field examination for Shoshone, Clearwater, and Latah counties is well along, but as yet not completed. No field work was done in Nezperce, Lewis, or Idaho counties. It is estimated that field work for the entire region can be completed in about 18 more months. If the same amount



of Survey funds are allotted for 1937 as were available in 1936, it would be possible to spend 10 more months during the field season on the fire depletion study. This will enable us to complete the field work in North Idaho and northeastern Washington.

"Blow-down" and flood losses on an average annual basis are considered to be negligible. Only one "blow-down" of importance, and this only in a rather restricted district, has occurred within the last twenty years. However, a further check will be made of such losses.

#### Growth Phase

The objective of this phase of the Survey is to determine the growth rate in old stands and on restocking areas and the probable future yields for the forest producing lands within the Northern Rocky Mountain region. The basic growth rate determined will then be applied to the forest resource data collected in the Inventory phase. The resulting figures will show the net growth after gross growth has been reduced by the losses due to cutting, fire, insects, and disease. Growth estimates for this purpose will cover:

1. Current annual growth. This is the actual growth for a single year.
2. Periodic annual growth. This is the average annual growth for any one year during a specified period.



Ten years will be the period used.

3. Potential annual growth. This is the mean annual growth estimated for the area based on the assumption that full series of age classes are established and all areas are average well stocked.

4. Realizable mean annual growth. This is an estimate of the actual average growth that is expected to occur in the future. This figure will show on the basis of assumed rates of depletion and assumed future growth on denuded lands, the average annual growth for the period 1935 to 2000.

Basic growth tables applicable to each major commercial species in the Region are necessary before actual growth estimates can be made. The following basic growth tables were available prior to 1936.

1. Normal western white pine yield tables.
2. Yield of selectively cut ponderosa pine.
3. Board-foot yield of selectively cut larch and Douglas fir.
4. Normal ponderosa pine yield tables.
5. Lodgepole pine yield tables.

#### Progress to Date

During the field season of 1935 and the winter of 1935-1936 a normal yield table was completed for larch-Douglas fir. In conjunction with the larch-Douglas fir



10 percent is poorly stocked. The average well stocked, yield study, stem analysis of enough larch trees was made to serve the basis for range wide volume tables. The average 51 percent, 40 percent, and 14 percent, respectively, of the normal yield table values. A cubic foot volume table in alignment chart form was also completed.

During the field season of 1936, application studies both in the western white pine type in North Idaho and the ponderosa pine type in northeastern Washington were completed. Sufficient information was taken in conjunction with the above studies to adjust the normal larch-Douglas fir yield table to fit Forest Survey typed areas in North Idaho and northeastern Washington.

On the basis of the stocking correlation studies conducted in the western white pine type, the average well stocked areas yield on the average 51 percent of normal yield table values, the medium stocked areas yield on the average 19 percent of normal yield table values and the average poorly stocked areas yield on the average 9 percent of normal yield table values. Interesting, also, is the fact that the entire western white pine type has been classified as being 60 percent well stocked, 30 percent medium stocked, and 10 percent poorly stocked. Similar studies carried out in the ponderosa pine type reveal that approximately 50 percent of the ponderosa pine type is well stocked, 40 percent is medium stocked and



10 percent is poorly stocked. The average well stocked, medium stocked, and poorly stocked areas will yield on the average 31 percent, 20 percent, and 14 percent, respectively, of the normal yield table values.

#### Plans for the Future

Other studies necessary to provide the Survey with complete growth rates and yield figures include:

1. Cedar pole increment study in uncut stands.
2. Application study of the interregional normal ponderosa pine yield tables to Forest Survey typed ponderosa pine areas in North Idaho and Montana.
3. A study of growth characteristics of virgin, mature ponderosa pine in north-central Idaho and Montana.
4. Increment study of selectively cut white pine areas.
5. Application study of the normal larch-Douglas fir yield tables to Forest Survey typed areas in Montana.
6. Construction of cubic foot increment tables for selectively cut larch-Douglas fir areas.
7. Determination of growth rates and application studies for immature Douglas fir stands in Montana.
8. Determination of growth rates and application studies for immature Engelmann spruce stands in Montana.
9. Increment study of selectively cut Engelmann spruce stands in Montana.



10. Application study of existing lodgepole pine yield tables to Forest Survey typed lodgepole pine areas in Montana.

11. Increment study of selectively cut lodgepole pine stands in Montana.

Unless emergency funds are allotted, work on this project will be confined to collection of data, and compilation and analysis of data. If, however, emergency

funds equal in amount to those provided the Survey project in 1936, are made available during 1937, it will be possible to do the following studies:

1. Cedar pole increment study in uncut stands.

2. Application of growth rates to inventory data in the northeastern Washington unit.

The Division of Silviculture at this Station is conducting an increment study of selectively cut western white pine stands and constructing cubic foot increment tables for selectively cut larch-Douglas fir stands.

These two studies should be completed during 1937.

It is estimated that with an annual allotment of \$19,765 usable growth rates and yield figures could be obtained for the entire region in two years. On a four-year plan basis \$9,500 is the estimated annual need.

Statistics of lumber



### Requirements Phase

The objectives of this phase of the Forest Survey are: (1) To determine the current need for forest products based on present consumption; (2) to determine the trends in the uses of forest products and the underlying causes for such trends, and (3) to determine the major opportunities for expansion in outlets for products of our forest land.

### Progress to Date

The collection of data on volume and type of construction in cities selected as sample plots has been completed. The cities selected are Missoula, Butte, Bozeman, Livingston, and Great Falls, Montana; Lewiston, Idaho, and Spokane, Washington. In several of the cities sampled, summaries showing the total volume of construction of living units provided annually, 1921-1930, inclusive; vacancy records and timber requirements for city and fence post requirements of the Northern Rocky Mountain Region were prepared. The building volumes for all buildings on 500 sample farms covered during 1925 were computed and tabulated. Data on total mileage of lines and annual timber requirements of nearly all of the principal telephone and electric utilities in Montana and North Idaho have been collected. Statistics of lumber



and miscellaneous timber products consumed by the copper mining and coal mining industries in Montana, and the lead-zinc-silver operations in North Idaho have been compiled and brought up to date. Data obtained from the Federal Civil Works Administration Farm Housing Survey of value in the analysis of rural timber requirements have been tabulated and summarized. In addition, to the information tabulated from the farm home schedules covering 4,804 farms in Montana and 4,465 farms in Idaho, data taken from the "Engineer" schedules for 804 houses in these States have been worked up. Through the use of suitable conversion factors prepared and applied to the quantitative data shown by the Engineer schedules, the total lumber requirements for repairs and additions to farm houses have been computed for each county sampled in the Survey.

During 1936, final reports covering the fuelwood and fence post requirements of the Northern Rocky Mountain Region were prepared. The building volumes for all buildings on 500 sample farms canvassed during 1935 were computed and tabulated. During the calendar year 1936, the total effective time spent on the Requirements Phase of the Survey amounted to approximately 12 man-months distributed about as follows: 2 months by Whitney, published by Bureau of Census reports "Construction Industry"



2 months by Hutchison, 3 months by an ERA clerk, and 5 months of CCC help on computing.

#### Plans for the Future

Unless considerably more money is available from emergency funds than last year, progress on the Requirements study will be limited to what can be done by Whitney in five months with some assistance from temporary employees on computing work. Whitney plans the following work for 1937: Recheck conversion factors obtained from bills of materials for urban construction and apply them to the building records for the cities which have been sampled. After converting urban building volumes to board feet compute total lumber requirements for both urban and rural residential and non-residential building construction in the Region. Summarize records showing quantities and form of material used by city and county governments for which detailed records have been obtained. Analyze information furnished by the Montana State Highway Commission on total quantities of lumber and other forest products used in Montana State roadways, as shown by contract lettings for the year 1932. Compute the volume of lumber required in State Highway Commission records but reported by contractors in the form of cost figures published by Bureau of Census reports "Construction Industry"



(Idaho and Montana, 1929). Obtain from the Bureau of Public Roads' office in Missoula, records on volume of forest products used in construction of forest highways, mileage of roads, etc., not covered by information from Montana State Highway Commission. Collect road construction data from Idaho State Highway Commission, Boise, Idaho. Obtain up-to-date lumber consumption data for several of the

Coeur d'Alene district mines. Collect records covering mileage of lines and timber products used by several of the North Idaho and northeastern Washington telephone and telegraph utility companies. After rounding up the information above as lacking, analyze and summarize as far as possible.

time will permit all records of lumber and timber products used for purposes other than building construction.

Much work still remains to be done on the Requirements Phase of the Survey in this Region. The work on project that forested the basis for a report on forest lands to be considered under the Pullman Act for State acquisition. Type maps and forest inventory data in detail are being demanded by the State Planning Boards as soon as it becomes available. An awkward situation has arisen in Montana where only

#### Application of Results

The demand for the results of the Forest Survey is increasing at a rapid rate. The two-inch-to-the-mile township type maps in color are being used wherever de-



tailed information on National Forest cover is needed in administration and planning work. Timber management plans are being revised on three of the major National Forests. Without Survey data in Montana available it was this winter and the Survey maps and acreage data are being used as the base. The cover type maps are being used for drainages.

many needs by the Regional Office of Lands, Timber Management, and Planting.

Donald Bruce, Forest Consultant for the Pacific Northwest Planning Commission, has requested Forest Survey data to replace that originally used in the Columbia Basin number of the two-inch-to-the-mile township type maps in Report. No Forest Survey data for the State of Montana can, of course, be released, as only a small portion of one-inch-to-the-mile unit type maps in county reports the State has been covered to date.

Such requests for Forest Survey data as are described briefly above are increasing more and more numerous.

The Idaho Planning Board used the one-inch-to-the-mile unit type maps and as much of the compilation as had been done for the area outside the National Forests in a project that formed the basis for a report on forest lands to be considered under the Fullmer Act for State acquisition. Type maps and forest inventory data in detail are being demanded by the State Planning Boards as soon as it becomes available. An awkward situation has arisen in Montana where only a very small percentage of the area has been covered by the Forest Survey to date.



The Water Resources Commission has made use of all the information available in their River Drainage project plans. Without Survey data in Montana available it was impossible to furnish the forest information by river drainages.

Donald Bruce, Forest Consultant for the Pacific Northwest Planning Commission, has requested Forest Survey data to replace that originally used in the Columbia Basin Report. No Forest Survey data for the State of Montana can, of course, be released, as only a small portion of the State has been covered to date.

Such requests for Forest Survey data as are described briefly above are becoming more and more numerous. It has been impossible to fill a great number of requests because the data are not yet available. The situation is becoming awkward and a special attempt should be made to increase the Survey funds (both regular and emergency) to this Station so that the entire job can be completed at the earliest opportunity.

There follows a brief tabulation showing the annual appropriation needed to complete all phases of the Survey in a two or four-year period.



Table 15.--Money needed to complete Forest Survey.

By H. T. Osborne, U.S.D.A.		Annual appropriation needed	
July	Unit	2-year plan	4-year plan
<i>"The Principles of Measuring Forest Fire Danger."</i>			
Northeastern Washington	Journal of Forestry, Vol. 31, No. 1, July, 1933.	\$ 3,000	\$ 1,000
North Idaho	August, 1933.	18,000	9,000
Montana		121,000	59,000
<i>"Fire Control Planning in the Northern Rocky Mountain Region."</i> By L. C. Hurst. Progress Report.			
Northern Rocky Mountain Region		\$142,000	\$69,000

*"Fuel Type Mapping, Its Relation to Forest Fire Control Planning."* By L. C. Hurst. Northwest Science, Vol. 15, No. 1, August, 1934.

*"The Character of the 1934 Fire Season in Region One."* By George H. Feltner. Applied Forestry Note No. 77, December, 1933.

*"Ranges of Northern Forests Differ From South."* By L. C. Hurst. Newspaper feature published in Salt Lake Tribune, Great Falls Tribune, Montana Standard, etc. September, 1934.

*"Recommendations to Improve Forest Exploitation Practices in the Inland Empire."* By I. V. Anderson and S.A.F. Committee. Mimeographed. December, 1934.

*"A Selective Logging Study of the Kinsella and Sons Tie Mill Operation Near Bonanza, Montana."* By I. V. Anderson. Mimeographed and multilithed. May, 1936.

*"Railroad Ties From Small Mills."* By I. V. Anderson. Parts I and II. The Timberman, vol. 36, nos. 1 and 2, November and December, 1934.

*"Utilization of Ties in Lodgepole Pine Forests of Northwestern Montana."* By I. V. Anderson. Great Tie Bulletin, vol. XVIII, no. 2, February, 1937.



STATUS OF PUBLICATIONS

PUBLISHED SINCE LAST REPORT

1. "Measuring Fire Weather and Forest Inflammability."  
By H. T. Gisborne. U.S.D.A. Circular No. 398.  
July, 1936. *Fire Re*
2. "The Principles of Measuring Forest Fire Danger."  
By H. T. Gisborne. Journal of Forestry, vol. 34,  
no. 8, August, 1936.
3. "Fire Control Planning in the Northern Rocky Mountain  
Region." By L. G. Hornby. Progress Report.  
Multilithed. September, 1936.
4. "Fuel Type Mapping, Its Relation to Forest Fire Control  
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Vol. 10, no. 3. August, 1936. *Lib*
5. "The Character of the 1936 Fire Season in Region One."  
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December, 1936.
6. "Ranges of Northern Great Plains Suffer From Drouth."  
By L. C. Hurtt. Newspaper feature published in  
Salt Lake Tribune, Great Falls Tribune, Montana  
Standard, etc. September, 1936. *Range Re*
7. "Recommendations to Improve Forest Exploitation Practices  
in the Inland Empire." By I. V. Anderson and  
S.A.F. Committee. Mimeographed. December, 1936. *Probu*
8. "A Selective Logging Study of the Kinshella and Sons  
Tie Mill Operation Near Lupfer, Montana. By  
I. V. Anderson. Mimeographed and multilithed.  
May, 1936. *Survey*
9. "Railroad Ties From Small Mills." By I. V. Anderson.  
Parts 1 and 2. The Timberman, vol. 38, nos. 1 and 2,  
November and December, 1936.
10. "Utilization of Ties in Larch-Douglas Fir Forests of  
Northwestern Montana." By I. V. Anderson. Cross Tie  
Bulletin, vol. XVlll, no. 2. February, 1937. *Learn*



11. "Comparative Cost of Making Logs From Small and Large Western White Pine Trees." By E. F. Rapraeger, West Coast Lumberman, vol. 63, no. 6, June, 1936. *Products*
12. "Effect of Repeated Ground Fires Upon Stumpage Returns in Western White Pine." By E. F. Rapraeger, Journal of Forestry, vol. 34, no. 7, July, 1936.
13. What Percent of the <sup>tree</sup> Volume is in Each Log of a Western (Idaho) White Pine." By E. F. Rapraeger, West Coast Lumberman, vol. 63, no. 8, August, 1936; Applied Forestry Note no. 75, May 15, 1936.
14. "Relation of Tree Size in Western White Pine to Log-making Costs." By E. F. Rapraeger. Applied Forestry Note no. 74.
15. "Timber Growing and Logging Practice in Ponderosa Pine in the Northwest." By R. H. Weidman, U.S.D.A. technical bulletin 511, June, 1936. *Silvi-culture*
16. "Factors Controlling Initial Establishment of Western White Pine and Associated Species." By I. T. Haig. Yale University, School of Forestry bulletin no. 41, 1936.
17. "Stand Improvement Measures for the Western White Pine Type." By K. P. Davis, in cooperation with Region One. Mimeographed. September, 1936.
18. "Test of Pruning Equipment and Methods in Western White Pine." By K. P. Davis, Applied Forestry Note no. 76, November, 1936.
19. "Cutting Depletion in the Northern Rocky Mountain Region Including Sawlog Depletion in Southern Idaho." By S. B. Hutchison and C. N. Whitney. A Forest Survey progress report. *Survey*
20. "Cutting Depletion and Requirements for Fuelwood in Region One." By S. B. Hutchison. A mimeographed progress report.
21. "Production and Consumption of Fenceposts in Montana, Northern Idaho, and Northeastern Washington." By S. B. Hutchison. A mimeographed progress report.



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2. "Effects of Drought on Vegetation Near Miles City,  
Montana." By L. Ellison and E. J. Woolfolk. Ecology.
3. "Recommendations to Improve Forest Exploitation Practices  
in the Inland Empire." By I. V. Anderson and S.A.F.  
Committee. Journal of Forestry.
4. "Racial Influences in a 25-Year Test of Ponderosa Pine."  
By R. H. Weidman. Journal of Agricultural Research.  
68 pp. Ms.

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2. "Effect of Low Vegetation on Rate of Spread of Fire in  
the Northern Rocky Mountains." By George M. Jemison.  
Journal of Forestry or Journal of Agricultural Research.  
30 pp. Ms.
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By H. T. Gisborne. Applied Forestry Note.
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Applied Forestry Note.
5. "Temperature Inversions at the Priest River Experimental  
Forest, Idaho, and Their Significance in Forest Fire  
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6. "Altitudinal Zonation of Some Variables of Fire Danger in  
the Northern Rocky Mountain Region." By G. L. Hayes.  
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7. "Calibration of Duff Hygrometers." By T. Kachin.  
Journal of Forestry.
8. "Calibration of Wood Cylinders." By T. Kachin.  
Journal of Forestry.



9. "Synopsis of Fire Control Planning For the Northern Rocky Mountain Region." By L. G. Hornby, Journal of Forestry.
10. "Haze and Smoke Visibility--Theory and Measurement." By G. D. Shallenberger and E. M. Little. Monthly Weather Review.
11. "A Comparison in Methods of Area Estimation on Short-grass Range." (Approximate title) By L. Ellison. Journal of Agricultural Research. 50 pp. Ms.
12. "Observers' Bias in Selection and Measurement of Shoots of Agropyron Smithii. (Approximate title). L. Ellison. Journal Agricultural Research. 15 pp. Ms.
13. "Drought, a Normal But Underestimated Element in Range Management." (In nature of progress report; experiment to continue.) Leon C. Hurtt. U. S. Department of Agriculture circular. 70 pp. Ms.
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15. "Too Early Grazing Undermines Range Welfare." Leon C. Hurtt. Montana Farmer. 6 pp.
16. "Restoration of Depleted Range Lands of Montana by Cheap Artificial Reseeding Methods." Leon C. Hurtt. U.S. Department of Agriculture circular. 60 pp.
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18. "Tree Grades for Ponderosa Pine of the Inland Empire." By I. V. Anderson. Technical circular. Published by cooperator.
19. "Lumber Production in the Northern Rocky Mountain Region Since 1869." By I. V. Anderson. Applied Forestry Note.
20. "Matches and Match Blocks From Idaho White Pine." By E. F. Rapraeger. Lumber trade journal.
21. "Adaptation of the Region One Power Saw to Logging." By I. V. Anderson. Trade journal article.



22. "Converting Factors for the Forest Industries of the Inland Empire." By E. F. Rapraeger, and I. V. Anderson. Trade Journal.
23. "Treatment of Farm Fence Posts." By C. N. Whitney. Montana Farmer.
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26. "Growth on Larch-Fir Cut-over areas in Western Montana." By R. H. Weidman, and C. L. James. Journal of Forestry.
27. "Growth on Western White Pine Cut-over Areas." By C. A. Wellner, and S. E. Brown. Journal Agricultural Research. 40 pp. Ms.
28. "Testing the Reliability of Height Over Diameter Curves for Western White Pine." By K. P. Davis. Journal Agricultural Research. 10 pp. Ms.
29. "Thinning in Western White Pine." Analysis of Priest River 1919 and 1914 thinning plots. By K. P. Davis. Journal of Forestry.
30. "Controlled Burning in Western White Pine." By K. P. Davis, and K. A. Klehm. Journal of Forestry.
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33. "Deception Creek Experimental Forest." Visitor's Guide. By K. P. Davis. Multilithograph.
34. "Priest River Experimental Forest." Descriptive leaflet. By C. A. Wellner. Multilithograph.
35. "Growth Statistics for Spokane, Stevens, and Pend Oreille Counties, Washington." By L. J. Cummings. A Forest Survey release.



35. "Priest River Experimental Forest." Visitor's Guide.  
By C. A. Wellner, Multilithograph.
36. "Observations on Freezing Damage to Conifers in Region  
One." By C. A. Wellner. Applied Forestry Note.
37. "Some Climatic Effects on Forest Stands and Forest  
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38. "Forest Statistics for Spokane County, Washington."
39. "A Forest Survey release. Forest Survey staff.  
and Maintenance of Urban Dwellings." By S. B.  
Same as above for Pend Oreille County, Washington.
40. " " " " Stevens County, Washington.
41. " " " " Benewah County, Idaho.
42. " " " " Bonner County, Idaho.
43. " " " " Boundary County, Idaho.
44. " " " " Kootenai County, Idaho.
45. " " " " Shoshone County, Idaho.
46. " " " " Nezperce County, Idaho.
47. " " " " Latah County, Idaho.
48. " " " " Lewis County, Idaho.
49. " " " " Clearwater County, Idaho.
50. "Condition of Cut-over and Burned-over Forest Lands  
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52. "Normal Yield Tables for Immature Even-aged Larch  
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53. "Growth Statistics for Spokane, Stevens, and Pend  
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A Forest Survey release.



54. "Cedar Pole Stand Tables for the Inland Empire Region." By L. J. Cummings. A Forest Survey release.
55. "Requirements for Forest Products in Construction and Maintenance of Farm Buildings." By C. N. Whitney. A Forest Survey progress report.
56. "Requirements for Forest Products in the Construction and Maintenance of Urban Dwellings." By C. N. Whitney. A Forest Survey progress report.
57. "Forest Products Requirements in the Mining Industries of Montana and North Idaho." By C. N. Whitney. A Forest Survey progress report.

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